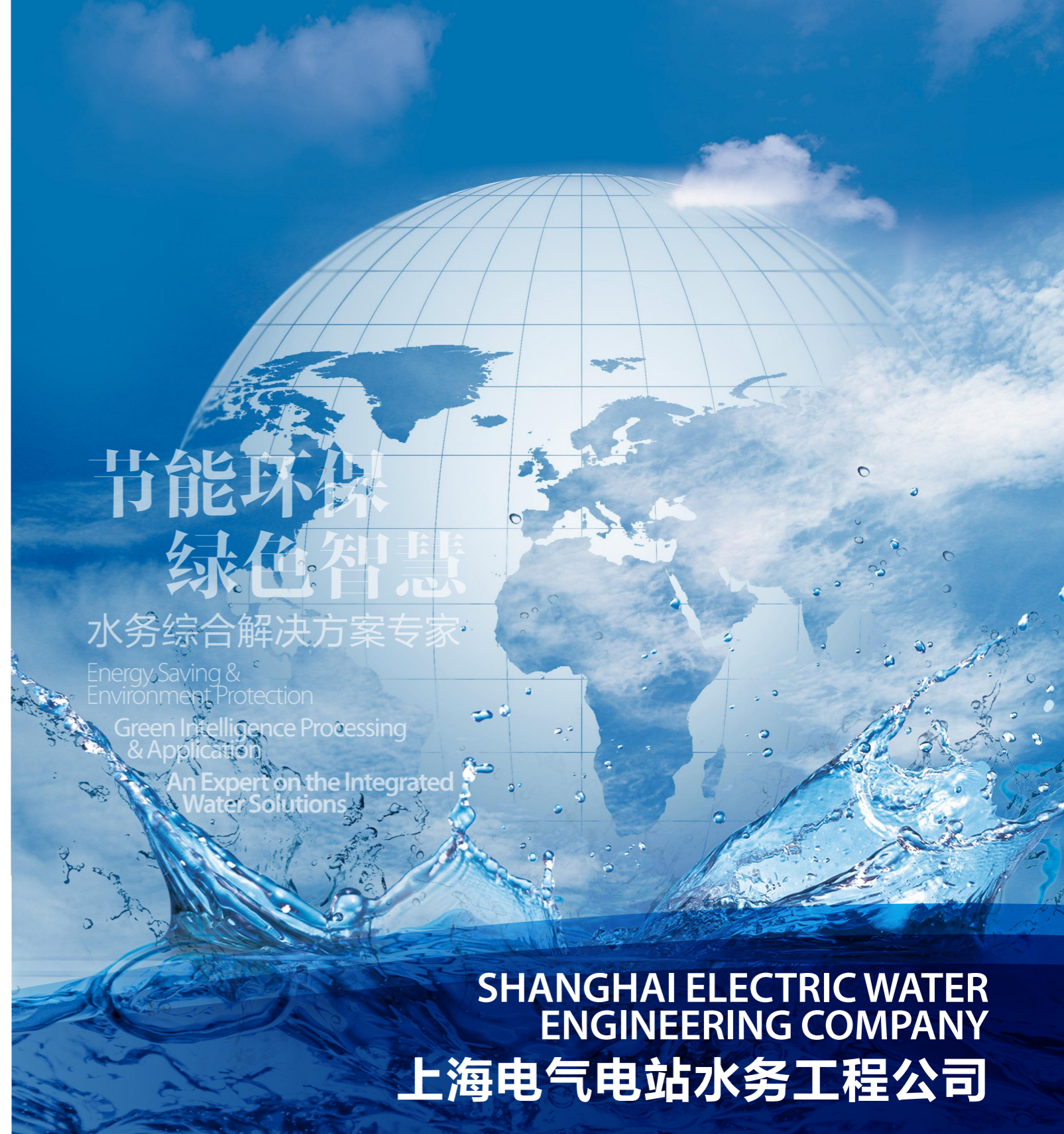


——上海电气 与创造者共创未来——  
SHANGHAI ELECTRIC  
CREATE OUR FUTURE TOGETHER

上海市杨浦区隆昌路 621 号 邮编：200090  
No.621 Longchang Road, Shanghai, China 200090  
电话：86-21-6070 3800 传真：86-21-6070 3880  
TEL:86-21-6070 3800 FAX:86-21-6070 3880  
网址：www.shanghai-electric.com



# 节能环保 绿色智慧

水务综合解决方案专家

Energy Saving &  
Environment Protection

Green Intelligence Processing  
& Application

An Expert on the Integrated  
Water Solutions

SHANGHAI ELECTRIC WATER  
ENGINEERING COMPANY  
上海电气电站水务工程公司

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AN EXPERT ON THE INTEGRATED  
WATER SOLUTIONS

# 水资源综合解决方案专家

崇尚协作、持续创新、引领未来  
ADVOCATING COORDINATION, INNOVATING  
CONSISTENTLY, LEADING FUTURE.

行业尊重、顾客满意、员工自豪  
INDUSTRY RESPECTING, CLIENT SATISFYING,  
EMPLOYEE PROUDING.

绿水青山 美好生活  
BETTER WATER BETTER LIFE

专心致志于水 极致服务于水  
FOCUSING ON WATER AND SERVING  
CUSTOMERS WITH PERFECTION

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# COMPANY PROFILE

## 公司介绍

上海电气是一家大型综合性高端装备制造企业，主导产业聚焦能源装备、工业装备、集成服务三大领域，致力于为全球客户提供绿色、环保、智能、互联于一体的技术集成和系统解决方案。产品包括火力发电机组（煤电、气电）、核电设备、风力发电设备、输配电设备、环保设备、自动化设备、电梯、轨道交通、医疗设备、油气化工和工业互联网等。

上海电气电站水务工程公司以脱盐技术为核心，过去十多年一直致力于海水淡化与废水处理技术的研发和应用，为用户提供EPC、BOO、BOT等模式的个性化水务综合解决方案。多效蒸馏（MED）、反渗透（RO）、纳滤（NF）、离子交换（IX）、电去离子（EDI）、载气萃取（CGE）和分盐结晶等多种脱盐技术，为国内外电力、钢铁、石化和水泥等多个行业客户提供一站式淡水资源解决方案，累计工程业绩总规模达130万吨/日，其中MED热法海水淡化工程总规模达52万吨/日，国内市场占有率在60%以上，膜法工程总规模达48万吨/日。2018年，上海电气进入国际脱盐协会（IDA）评出的全球前十大海水淡化与水再利用项目开发商，2019年位列全球第七名，2022-2023年位列第九名。

上海电气电站水务工程公司持续储备和自主研发海水淡化与废水处理技术，已攻克多项海水淡化与废水处理领域的核心技术瓶颈，形成了一批具有自主知识产权的科研成果。目前公司开发21个专业计算软件、建立9个数据库、搭建15个实验平台、获得授权专利33项、制定13项企业标准，研发成果处于国内领先水平。

Shanghai Electric is a large integrated equipment manufacturing group specialized in energy equipment, industrial equipment and integration services. It is committed to providing customers with solutions to technology integration and systems incorporating green, eco-friendliness, intelligence and interconnection. Its products include thermal generator set (coal power, gas power), nuclear power equipment, wind power equipment, power T&D equipment, environmental protection equipment, automation equipment, elevators, rail transit equipment, medical equipment, Oil, Gas & Chemical Engineering and Industrial Internet, etc.

Shanghai Electric Water Engineering Company (SWE) has been engaged in continuous technical innovation in core desalination technologies. In the past more than ten years, SWE devoted to the R&D and applications of seawater desalination and industrial wastewater and has the ability to provide services including EPC, BOO, BOT, etc. So far SWE has owned different desalination technologies in the field of seawater, wastewater and boiler feed water such as MED, RO, NF, IX, EDI, CGE MVR and TVR. The total project capacity is up to 130000 t/d by the end of 2023. The MED project capacity is up to 520000 t/d, the domestic market share is above 60 percent, the RO project capacity is up to 480000 t/d. In the year 2018-2019 and 2022-2023, Shanghai Electric was listed in the top 10 project developers of seawater desalination and water reclamation by International Desalination Association (IDA).

SWE focuses on R&D for seawater desalination and wastewater treatment technology innovation and engineering application. SWE has made a breakthrough in several key desalination technologies and gained many achievements in intellectual property rights through continuous technical accumulation and improvement. So far SWE has successfully completed and developed 21 professional computation software, 9 databases, 15 experimental platforms, 33 patents, 13 internal company standards.

上海电气为海水淡化与废水处理提供了从技术研发设计、产品制造到项目建设、运维服务及商业运行模式等全方面的硬件、软件支持。

Shanghai Electric has provided the technology R&D, product manufacture, project management, operational service, market sales mode and commercial capital chain, and other aspects of the hardware and software support.

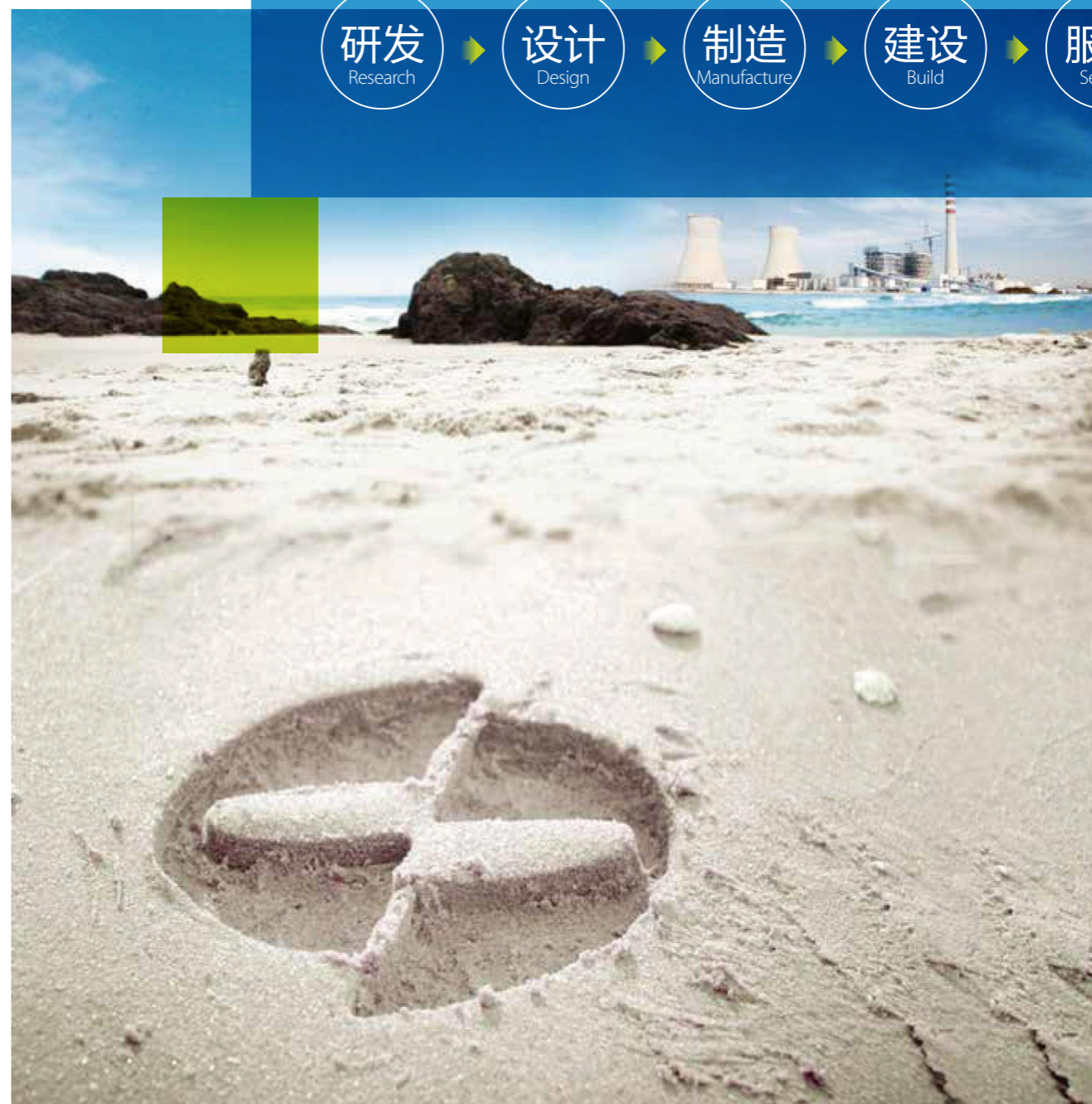
研发  
Research

设计  
Design

制造  
Manufacture

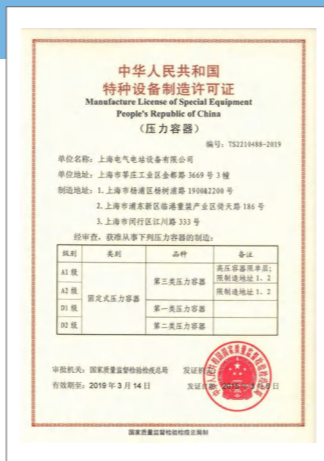
建设  
Build

服务  
Service



# 品质承载梦想，服务决定未来

QUALITY CARRIES THE DREAM, SERVICE DETERMINES THE FUTURE



# 健全的质量服务保障

PERFECT QUALITY ASSURANCE AND SERVICE GUARANTEE

工业服务将帮助您充分挖掘潜能。我们可提供涵盖整个项目与设备生命周期的全面而广泛的产品、系统和服务产品，从规划设计、操作运行一直到后期的升级改造。全面提升机组运行的可靠安全性，降低能量消耗，帮助客户有效降低工厂运营成本，实现节能目标，提高竞争力。

Industrial services will help you fully exploit potential. We can offer a comprehensive and extensive product, process system and service that covers the entire project and equipment lifetime, from the planning and design, operation until the subsequent upgrade. We can comprehensively enhance the reliability of unit operation, reduce energy consumption, help customers effectively reduce OPEX, achieve saving-energy goals, improve competitiveness.



## 专利清单 PATENT LIST

专利名称	专利号/登记号	类型
一种核能与低温多效海水淡化耦合联产的系统 A hybrid desalination technology about nuclear power and MED	2013106557122	发明专利 Patent for invention
一种高背压机组配套低温多效海水淡化的水电联产系统 A water and power cogeneration system with high pressure steam turbine coupled with LT-MED	2017107116093	发明专利 Patent for invention
一种缺氧好氧生化一体化装置 A hypoxia aerobic biochemical integrated device	2019110907183	发明专利 Patent for invention
热水加热低温多效蒸馏海水淡化装置 Hot water heating LT-MED device	2020229339645	实用新型专利 Patent for utility models
一种基于废水多级闪蒸-低温多效蒸馏的海水淡化系统 A seawater desalination system based on wastewater multi-stage flash evaporation - low temperature multi effect distillation	2021232533715	实用新型专利 Patent for utility models
热量梯级利用及海水高倍浓缩的热膜耦合海水淡化系统 Heat cascade recycling and high magnification concentration of seawater in thermal and membrane hybrid seawater desalination system	2023219717114	实用新型专利 Patent for utility models
一种零泄露核能利用多效蒸馏海水淡化系统 A zero leakage nuclear energy utilization multi effect distillation seawater desalination system	2023219554973	实用新型专利 Patent for utility models
用于反渗透膜堆高压浓水侧高点排气及破虹吸的管路结构 Pipeline structure used for high-pressure concentrated water side high spot exhaust and breaking siphon of RO membrane stack	2023220715001	实用新型专利 Patent for utility models

# 水务公司业绩分布 PROJECT REFERENCES

- MED海淡项目：总量520000 m<sup>3</sup>/d
- RO 海淡项目：总量290000 m<sup>3</sup>/d
- 含盐水处理项目：总量540000 m<sup>3</sup>/d

● 浙江嘉兴独山能源540万吨对苯二甲酸工程43200m<sup>3</sup>/d中水回用及脱盐水处理项目

Dushan Energy 43200 m<sup>3</sup>/d Reclaimed Water Reuse and Demineralized Water Project

● 江苏无锡利港电厂720m<sup>3</sup>/d废水浓缩减量项目

Jiangsu Wuxi Ligang Power Plant Desulfurization Wastewater ZLD Demonstration Project

● 塞尔维亚 8,640m<sup>3</sup>/d 锅炉补水工程项目

Serbia 8640 m<sup>3</sup>/d RO Project

● 伊拉克华事德4800m<sup>3</sup>/d 锅炉补水工程项目

Iraq Wassit 4800 m<sup>3</sup>/day Demineralization Project

● 伊拉克米桑燃气联合循环电站3168m<sup>3</sup>/d锅炉补水工程项目

Iraq Maisan GTCC Power Plant 3168 tons/d Project

● 巴基斯坦塔尔电厂6240m<sup>3</sup>/d工程项目

Pakistan Thar Power Plant 6240 m<sup>3</sup>/d Project

● 卡塔尔35万吨PVC配套4128m<sup>3</sup>/d脱盐水项目

Qatar 4128 m<sup>3</sup>/d Demineralized Water Project

● 迪拜光热9600m<sup>3</sup>/d除盐水工程项目

Dubai CSP&PV Hybrid 9600 m<sup>3</sup>/d Project

● 巴拿马科隆海水-3,618m<sup>3</sup>/d 除盐水-1,440 m<sup>3</sup>/d项目

Panama Gas Turbine Power Plant 3618 m<sup>3</sup>/d Project

● 也门亚丁炼油4320m<sup>3</sup>/d 海水淡化工程项目

Yemen Aden oil refinery Phase ( I ~ II ) 4320 m<sup>3</sup>/d MED project

● 孟加拉锡莱特960m<sup>3</sup>/d项目

Sylhet, Bangladesh 960 m<sup>3</sup>/d

● 浙江荣翔热力有限公司17424m<sup>3</sup>/d锅炉补水项目

Zhejiang Rongxiang 17424 m<sup>3</sup>/d Boiler Make-up Water Project

● 陕西煤业化工集团3360m<sup>3</sup>/d 除盐水扩建工程项目

Shanxi Coal and Chemical Industry Group 3360 m<sup>3</sup>/d Demineralized Water Project

● 海螺水泥金陵河480m<sup>3</sup>/d项目

Conch Cement Jinlinhe 840 m<sup>3</sup>/d Circulating Cooling Wastewater ZLD Project

● 海螺水泥凤凰山840m<sup>3</sup>/d项目

Conch Cement Fenghuangshan 840 m<sup>3</sup>/d Circulating Cooling Wastewater ZLD Project

● 河北黄骅沧东电厂二期12,500m<sup>3</sup>/d项目

HeBei HuangHua Cangdong Power Plant Phase II 12500 m<sup>3</sup>/d MED project

● 河北黄骅沧东电厂三期25,000m<sup>3</sup>/d项目

HeBei HuangHua Cangdong Power Plant Phase III 25000 m<sup>3</sup>/d MED project

● 河北秦皇岛热电6000m<sup>3</sup>/dEPC工程项目

HeBei QinHuangdao Power Plant 6000 m<sup>3</sup>/d MED project

● 河北丰南丰越能源25000m<sup>3</sup>/dEPC工程项目

HeBei Fengnan Fengyue Energy 25000 m<sup>3</sup>/d MED Desalination Project under EPC Mode

● 河北丰南丰越能源75,000m<sup>3</sup>/dEPC工程项目

HeBei Fengnan.Fengyue Energy 75000 m<sup>3</sup>/d Desalination Project under EPC Mode

● 山东裕龙石化热工单元232800m<sup>3</sup>/d除盐水项目

Shandong Yulong Petrochemical 232800 m<sup>3</sup>/d Demineralized Water Project (EPC)

● 山东裕龙石化160000m<sup>3</sup>/d 热膜耦合海淡项目

Shandong Yulong Petrochemical 160000 m<sup>3</sup>/d RO-MED hybrid Project (EPC)

● 连云港盛邦新材料4080m<sup>3</sup>/d脱盐水项目

Jiangsu Shengbang Holding Group 4080 m<sup>3</sup>/d Demineralized Water Project

● 浙江舟山浙石化305000m<sup>3</sup>/d EPC工程项目

ZheJiang Zhoushan Petrochemical 305000 m<sup>3</sup>/d MED project

● 广东惠来 11880m<sup>3</sup>/d 反渗透海水淡化工程项目

Guangdong Huilai 11880 m<sup>3</sup>/d RO Project

● 广东粤电惠来电厂13464m<sup>3</sup>/d 海水淡化及锅炉补水项目

Guangdong Yuedian Huilai Power Plant 13464 m<sup>3</sup>/d Seawater Desalination and Boiler Make-up Water Project

● 广东阳西电厂 4128m<sup>3</sup>/d 锅炉补水工程项目

GuangDong YangXi Power Plant 4128 m<sup>3</sup>/d Demineralization Project

● 广东湛江宝钢湛江钢铁30,000m<sup>3</sup>/dEPC工程项目

Guangdong Zhanjiang BaoGang Zhanjiang Steel 30000 m<sup>3</sup>/d MED project with EPC mode

● 菲律宾康赛普森2640m<sup>3</sup>/d项目

Philippine PCPC Power Plant 2640 m<sup>3</sup>/d RO Project

● 越南永新9600m<sup>3</sup>/d 反渗透海水淡化工程项目

Vinh Tan Power Plant 9600 m<sup>3</sup>/d RO Project

● 印尼棉兰6552m<sup>3</sup>/d 反渗透海水淡化工程项目

Medan KIM 6552 m<sup>3</sup>/d RO Project

● 印尼公主港 7680m<sup>3</sup>/d 反渗透海水淡化工程项目

Pelabuhanratu Power Plant 7680 m<sup>3</sup>/d RO Project

● 文莱恒逸石化37500m<sup>3</sup>/d 海水淡化工程项目

PMB,Brunei 37500 m<sup>3</sup>/d MED project

● 印尼北加电厂5760m<sup>3</sup>/d 锅炉补水项目

Indonesia Kalimantan Utara Power Plant 5760 m<sup>3</sup>/d Boiler Make-up Water Project

● 马来西亚巴林基安工业废水-6240m<sup>3</sup>/d 除盐水3312m<sup>3</sup>/d项目

Bahrainkian,Malaysia 3312 m<sup>3</sup>/d Desalination &Wastewater Treatment Project

# CORE TECHNOLOGY AND INDEPENDENT INNOVATION

## 自主创新的 核心技术

### 低温多效蒸馏技术

高效、节能、经济、安全可靠的热法脱盐技术

#### LOW TEMPERATURE MULTIPLE EFFECT DISTILLATION (LT-MED)

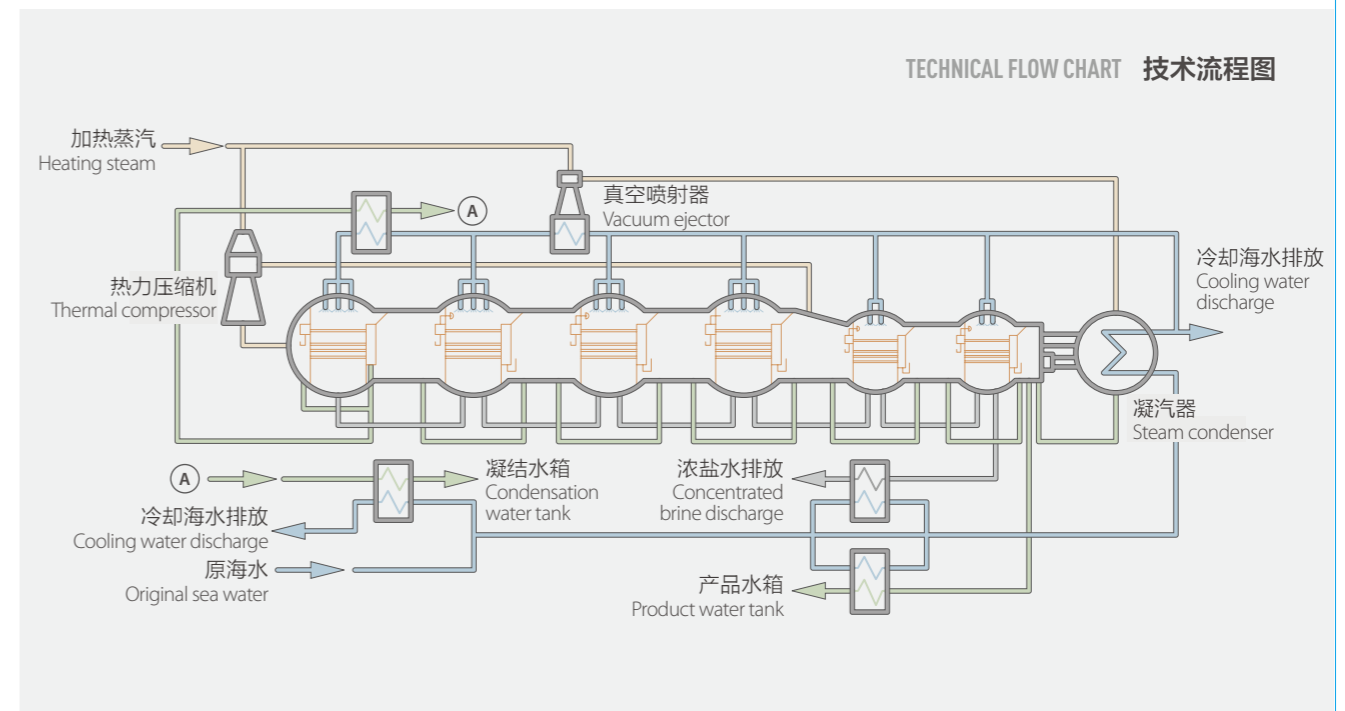
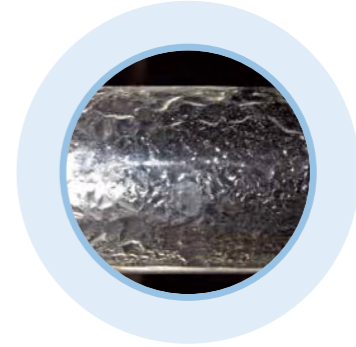
HIGH EFFICIENCY, ENERGY SAVING, ECONOMICAL, SAFE AND RELIABLE THERMAL DESALINATION TECHNOLOGY

由于MED海水淡化技术具有传热效率高，产品水水质好，负荷调节范围大，操作温度低，结垢腐蚀倾向小等优点，目前已经成为第二代热法海水淡化的主流技术。与电厂结合的大型化MED将是经济可靠的水电联产技术方法之一，是热法海水淡化发展方向。

上海电气长期致力于低温多效海水淡化技术和产品的开发，公司通过不断自主研发和技术创新，在系统设计、工艺计算、设备设计制造和工程服务等方面在国内均处于领先地位，目前公司具备单机5万吨/天及以上MED设备成套供应和海水淡化岛工程总包能力。

LT-MED has become the second-generation of thermal desalination technology because it has lots of advantages, including high efficient heat transfer, high water quality, large adjustable load, low operation temperature and low risky scaling trend. It is widely used in the power plant to form cogeneration model with supply reliable power and high quality water at the same time, which is the future development direction of thermal desalination technology.

Shanghai Electric is committed to developing LT-MED technology. The company has taken the leading position through continuous technical development and innovation, especially about system design, process calculation, equipment design/manufacture, and engineering service. It has the ability to design and supply whole set of MED equipment with more than 50000t/d capacity per unit under EPC mode.





根据国际脱盐协会统计，2017-2018年，上海电气跻身全球海水淡化与水再利用前10名。

Shanghai Electric stand among the top 10 plant suppliers in terms of contracted capacity between 2017 and 2018 International Desalination Association (IDA).



## 热法海水淡化工程业绩 MED PROJECT REFERENCES

序号 NO.	国家/地区 Country/Region	行业 Industry	项目名称 Project Name	产水量 Capacity	投运时间(year) CommissionTime
1	中国河北 HeBei,China	电力 Electric Power	河北黄骅·沧东电厂二期 HeBei HuangHua Cangdong Power Plant Phase II	12500m <sup>3</sup> /d	2008
2	中国河北 HeBei,China	电力 Electric Power	河北黄骅·沧东电厂三期 HeBei HuangHua Cangdong Power Plant Phase III	25000m <sup>3</sup> /d	2013
3	中国河北 HeBei,China	电力 Electric Power	秦皇岛热电厂 QinHungdao Power Plant	6000m <sup>3</sup> /d	2017
4	中国广东 Guangdong,China	钢铁 Steel	广东湛江·宝钢湛江钢铁 Guangdong Zhanjiang.BaoGang Zhanjiang Steel	30000m <sup>3</sup> /d	2015
5	中国河北 HeBei,China	钢铁 Steel	河北丰南·丰越能源 HeBei Fengnan.Fengyue Energy	25000m <sup>3</sup> /d	2019
6	中国浙江 ZheJiang,China	石化 Petrochemical	浙江舟山·浙石化一期 Zhejiang Petrochemical MED Project Phase I(EPC)	105000m <sup>3</sup> /d	2019
7	文莱 Brunei	石化 Petrochemical	恒逸(文莱)PMB石化 PMB,Brunei	37500m <sup>3</sup> /d	2019
8	也门亚丁 Yemen Aden	石化 Petrochemical	也门亚丁炼油厂一期 Yemen Aden oil refinery Phase I	2160m <sup>3</sup> /d	2019
9	也门亚丁 Yemen Aden	石化 Petrochemical	也门亚丁炼油厂二期 Yemen Aden oil refinery Phase II	2160m <sup>3</sup> /d	2020
10	中国浙江 ZheJiang,China	石化 Petrochemical	浙江舟山·浙石化二期 Zhejiang Petrochemical MED Project Phase II	200000m <sup>3</sup> /d	2022
11	中国烟台 Yantai,China	石化 Petrochemical	山东裕龙石化热法海淡项目 Shandong Yulong Petrochemical MED Project (EPC)	80000m <sup>3</sup> /d	2024

## 独家6大技术优势

增加源水处理效率，优化系统装备，保障生产安全可靠

EXCLUSIVE SIX MAJOR TECHNICAL ADVANTAGES  
TO INCREASE THE EFFICIENCY OF WATER TREATMENT EQUIPMENT,  
OPTIMIZE THE SYSTEM, ENSURE THE PRODUCTION SAFETY

1 小温差高效传热管束结构设计技术  
Small temperature difference efficient heat transfer tube bundle structure design technology

2 物料水系统回热设计技术  
Design technology of material water return system

3 盐水和淡水闪蒸精确计算模型  
The precise model of saline and fresh water flash

4 不凝气计算模型和系统设计技术  
Non condensing gas calculation model and non condensing gas system design technology

5 丝网除雾器选型与设计布置技术  
Selection and design of the screen mist sprayer

6 防腐防垢组合设计技术  
Combined design of corrosion and scale prevention

MED PROJECT  
热法项目



## HEBEI HUANGHUA CANGDONG POWER PLANT PHASE II 12500 TONS/D MED PROJECT

# 河北黄骅·沧东电厂二期12500吨/天海淡项目

业主(Owner):	河北国华沧东发电有限责任公司 Hebei Guohua Cangdong Generation Co. Ltd.
容量(Capacity):	12500m <sup>3</sup> /d
技术方法(Technical Method):	MED-TVC
所在地(Project Location):	河北省沧州市 Cangzhou, Hebei Province
完成时间(Completion Time):	2008年12月 Dec. 2008

项目性能参数表 PROJECT PERFORMANCE PARAMETER TABLE

项目 Item	单位 Unit	技术数据 Technical Data
装置容量 Installed Capacity	m <sup>3</sup> /d	12500
装置数量 Number of Devices	套 set	1
技术工艺 Technical Process	--	MED-TVC
蒸发器效数 Evaporator Effect Number	--	4+2
造水比 GOR	kg/kg	10.2
产品水水质 Desalination Quality	mg/L	≤ 5
负荷调节范围 Load Regulation Range	%	50~110
年利用率 Annual Utilization Ratio	%	95
设计寿命 Design Life	年 year	30



国内首套万吨级MED国产化项目  
THE FIRST 10,000T/D CLASS MED DOMESTICALLY  
CONSTRUCTED PROJECT IN CHINA



国家能源及科技进步奖  
NATIONAL ENERGY ADMINISTRATION SCIENCE AND  
TECHNOLOGY PROGRESS AWARD



国家电力科学技术奖  
CHINA POWER SCIENCE AND TECHNOLOGY AWARD

国华沧东电厂二期海水淡化工程是国内首套万吨级低温多效蒸馏海水淡化国产化项目，其中主设备由上海电气负责自主设计制造、成套供货，并提供安装调试服务。项目于2008年12月19日成功达产，各项性能指标达到设计值，标志着国产化低温多效蒸馏海水淡化技术装备获得重大突破和发展。上海电气通过项目实施编制了设计制造企业标准，形成了成套主设备设计、制造和质保体系。本项目经电厂用户沧东发电有限责任公司工程完工数据测算，二期项目同一期进口进口设备相比，工程总投资大幅降低，同比下降28%，吨水综合成本同比下降26%，国产化技术装备经济效益十分显著。项目于2009年荣获中国电力科学技术奖一等奖，2010年荣获国家能源局科技进步一等奖。

Huanghua phase II project is the first 10,000t/d class MED domestically constructed project in China. Shanghai Electric was responsible for the design and manufacture of the main equipment, the complete set supplying, installation and commissioning. The project successfully reached design capacity on December 9, 2008, all the performance parameters were in accordance with the design value, which marked a significant breakthrough about domestical manufacturing of MED desalination device in China. Shanghai Electric has issued the design and manufacturing enterprise standard, formed the design and manufacturing system of complete sets of main equipment, and quality assurance system through the project implementation. According to client's calculation of measured data, the CAPEX of phase II project has been reduced by 28%, specific cost of distillate has been reduced by 26% compared to imported equipment used in phase I project, which achieved remarkable economic benefits. The project won the first prize of China Power Science and Technology Award in 2009, and won the first prize of National Energy Administration Science and Technology Progress Award in 2010.

与进口设备相比 COMPARED WITH THE IMPORTED EQUIPMENT



工程总投资  
Total project  
Investment

同比下降 DROP  
**28%**



吨水综合成本  
Tons of Water  
comprehensive cost

同比下降 DROP  
**26%**



MED PROJECT  
热法项目



HEBEI HUANGHUA CANGDONG POWER PLANT PHASE III  
25000 TONS/D MED PROJECT

河北黄骅·沧东电厂三期25000吨/天海淡项目

业主(Owner):

河北国华沧东发电有限责任公司  
Hebei Guohua Cangdong Generation Co. Ltd.

容量(Capacity):

25000m<sup>3</sup>/d

技术方法(Technical Method):

MED-TVC

所在地(Project Location):

河北省沧州市 Cangzhou, Hebei Province

完成时间(Completion Time):

2013年12月 Dec. 2013

项目性能参数表 PROJECT PERFORMANCE PARAMETER TABLE

项目 Item	单位 Unit	技术数据 Technical Data
装置容量 Installed Capacity	m <sup>3</sup> /d	25000
装置数量 Number of Devices	套 set	1
技术工艺 Technical Process	--	MED-TVC
蒸发器效数 Evaporator Effect Number	--	7+3
造水比 GOR	kg/kg	13
产品水水质 Desalination Quality	mg/L	≤ 5
负荷调节范围 Load Regulation Range	%	40~110
年利用率 Annual Utilization Ratio	%	95
设计寿命 Design Life	年 year	30



国产化单机最大的热法海淡项目  
THE LARGEST PER-UNIT INSTALLED CAPACITY DOMESTICALLY  
CONSTRUCTED THERMAL DESALINATION PROJECT



中国电力创新奖  
CHINA POWER INNOVATION AWARD

该项目填补国产化MED单机2.5万吨/日的技术空白，项目主设备由上海电气负责设计、制造并提供安装调试服务。设计开发团队还突破了换热管的排列、横管传热降膜、蒸汽流动和应力分析等技术难点，形成多项超大型MED圆筒蒸发器自主核心设计技术。项目的成功标志着上海电气在低温多效蒸馏海水淡化蒸发器主设备国产化的道路上更进一步，其设计制造技术跻身世界先进行列。

The project filled in the technical gap of domestically constructed MED with per-unit installed capacity 25000 tons/day. Shanghai Electric was responsible for the design, manufacture of the main equipment, installation and commissioning. The design and development team overcame the technical difficulties of heat exchange tube arrangements, horizontal-tube falling film heat transfer, vapor flow and stress analysis, mastered a number of independent core design technology about super-large MED cylinder evaporator. The success of the project marked that Shanghai electric is one step further on the way of domestically construction of low-temperature multi-effect distillation seawater desalination evaporator, and its design and manufacturing technology ranks among the world's most advanced level.

国内首创

FIRSTLY INVENTED IN DOMESTIC

MED 蒸发器双管束设计、新型管束设计

MED evaporator double tube bundles design, new type tube bundle design

传热效率  
Heat transfer  
efficiency

提高 IMPROVE ↑

**5.04%**

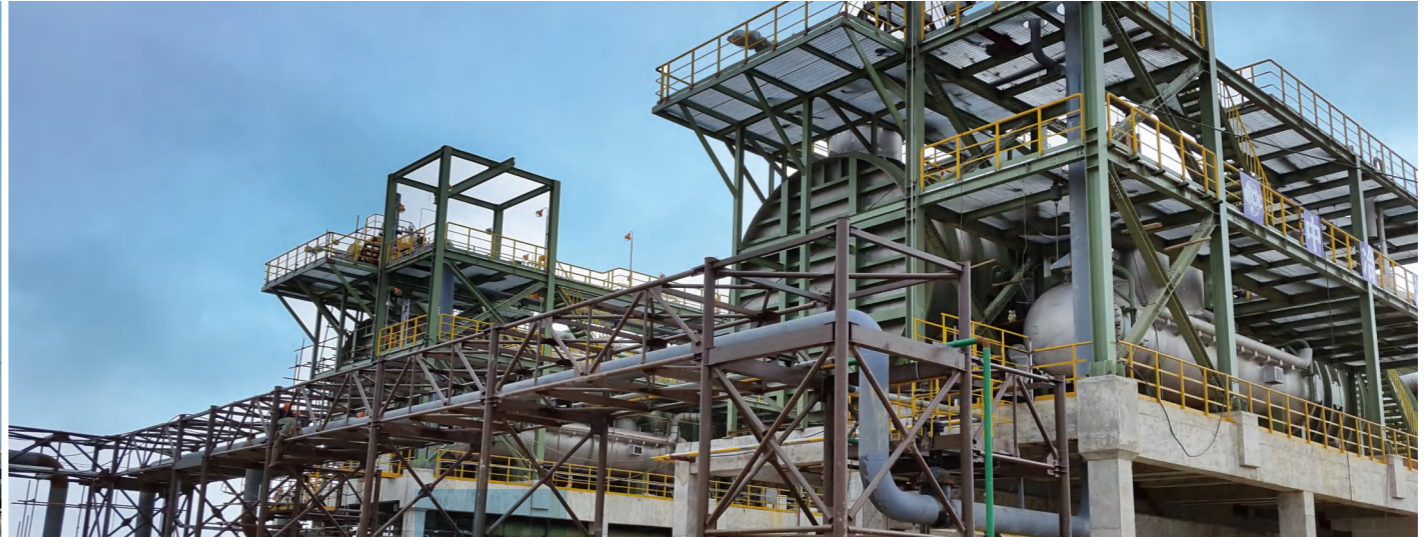
蒸汽流动阻力损失合计减少 1°C  
The resistance loss of vapor flow has been reduced by 1°C

设备投资  
Equipment  
Investment

减少 REDUCE ↓

**3.52%**

MED PROJECT  
热法项目



GUANGDONG ZHANJIANG BAOGANG ZHANJIANG STEEL 30000 TONS/D MED  
PROJECT WITH EPC MODE

广东湛江·宝钢湛江钢铁  
30000吨/天海淡EPC项目

业主(Owner):

宝钢湛江钢铁有限公司  
Hebei Guohua Cangdong Generation Co. Ltd.

容量(Capacity):

30000m<sup>3</sup>/d

技术方法(Technical Method):

MED-TVC

所在地(Project Location):

广东省湛江市 Zhanjiang, Guangdong Province

完成时间(Completion Time):

2015年11月 Nov. 2015

项目性能参数表 PROJECT PERFORMANCE PARAMETER TABLE

项目 Item	单位 Unit	技术数据 Technical Data
装置容量 Installed Capacity	m <sup>3</sup> /d	15000
装置数量 Number of Devices	套 set	2
技术工艺 Technical Process	--	MED-TVC
蒸发器效数 Evaporator Effect Number	--	7
造水比 GOR	kg/kg	10
产品水水质 Desalination Quality	mg/L	≤ 5
负荷调节范围 Load Regulation Range	%	50~110
年利用率 Annual Utilization Ratio	%	95
设计寿命 Design Life	年 year	30

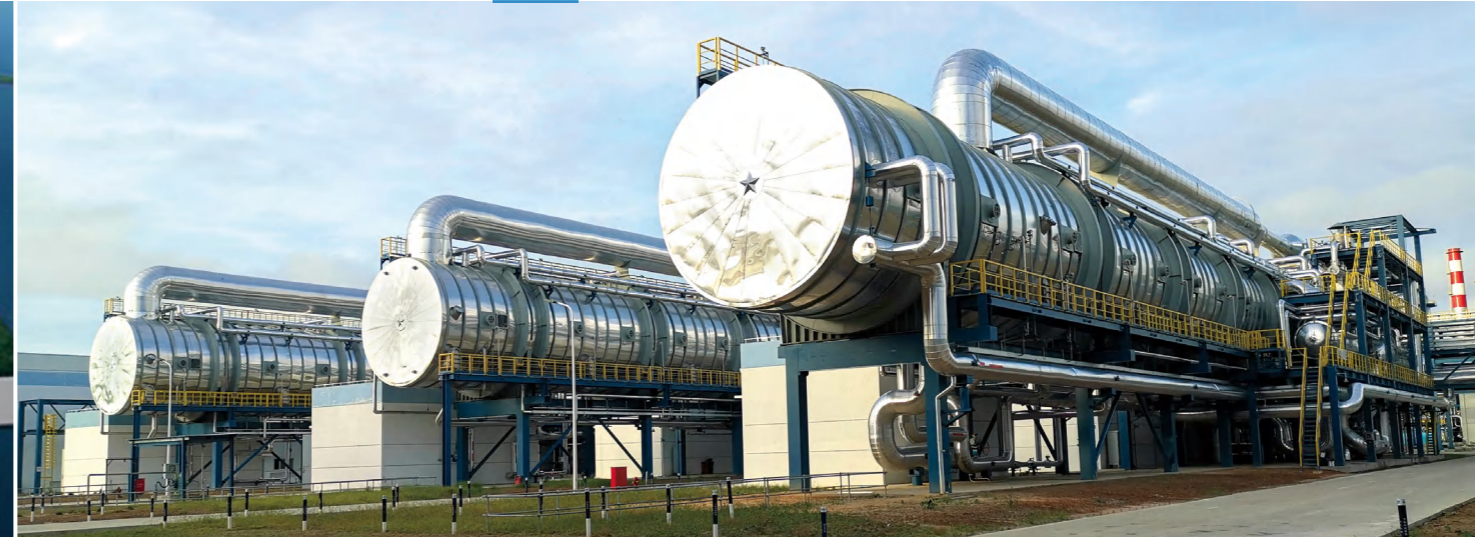


国内首个热法海水淡化EPC项目  
THE FIRST DOMESTIC THERMAL SEAWATER DESALINATION EPC PROJECT

该项目由上海电气工程EPC总承包，填补了国产化海水淡化项目运作模式空白。项目设计团队在技术方案进行创新设计，一方面充分利用钢厂乏汽制水，实现钢厂乏汽零排放目标；另外结合实际取水条件和排水要求，物料水系统设计成高低压物料水系统和配套分级加药系统，不但实现节省电耗和药耗等运行费用，而且大大提高系统长期运行稳定性和可靠性。同时上海电气还充分整合热法海水淡化产业创新战略联盟资源优势，成功实现国产化双相不锈钢材料在热法海淡首次工程应用突破，进一步提升国产化热法海水淡化技术装备水平和上下游产业链竞争力。项目于2015年11月投运，造水比、电耗、产水电导等关键技术指标处于国际一流水平。

The EPC project is contracted by Shanghai Electric, and fills the gap in the business mode of domesticized desalination project. The project team takes an innovative design in the aspect of technical solutions. On one hand, it makes full use of the steel mill's waste steam to produce water so as to achieve the goal of zero emissions of steel mill waste steam; on the other hand, combined with the actual conditions of water intake and the requirements of drainage, the feed water system is designed for two branch system and grading dosing system, which not only lower the operating costs of power consumption and chemical consumption, but also greatly improves the stability and the reliability in the long term operation of the system. Meanwhile, Shanghai Electric fully integrates the resources of thermal desalination industry innovation strategic alliance, successfully realizing a breakthrough that duplex stainless steel materials firstly applied in the thermal desalination of the project in domestic, to further enhance the technology and equipment level of the thermal desalination localization and the competitiveness of upstream and downstream industry chain. The project was put into operation in Nov.2015, whose parameters of GOR, power consumption, product water and conductivity are all in a world-class level.

## MED PROJECT 热法项目



国内出口规模最大热法海水淡化项目  
THE LARGEST EXPORT SCALE MED PROJECT

## PMB, BRUNEI 37500 TONS/D MED PROJECT

### 文莱·恒逸石化37500吨/天海淡项目

业主(Owner):

恒逸实业(文莱)有限公司  
Hengyi Industries Sdn Bhd

容量(Capacity):

37500m<sup>3</sup>/d

技术方法(Technical Method):

MED-TVC、F-MED

所在地(Project Location):

文莱 Brunei

完成时间(Completion Time):

2019年

项目性能参数表 PROJECT PERFORMANCE PARAMETER TABLE

项目 Item	单位 Unit	技术数据 Technical Data
装置容量 Installed Capacity	m <sup>3</sup> /d	12500
装置数量 Number of Devices	套 set	3
技术工艺 Technical Process	--	MED-TVC/F-MED
蒸发器效数 Evaporator Effect Number	--	6
造水比 GOR	kg/kg	10.4
产品水水质 Desalination Quality	mg/L	≤ 10
负荷调节范围 Load Regulation Range	%	50~110
年利用率 Annual Utilization Ratio	%	95
设计寿命 Design Life	年 year	30

恒逸文莱3 × 12500吨/日低温多效海水淡化EP项目是目前国内出口的最大规模热法海水淡化项目。在该项目中首次提出并采用了低温多效蒸馏工艺结合热水闪蒸技术制备淡水，通过低品位热水作为热法海水淡化的热源，大大降低了海水淡化的制水成本，进一步扩大了市场占有率，让上海电气海水淡化技术继续保持领先水平。

Hengyi (Brunei) petrochemical construction 3x12500 tons/day of low temperature multi-effect seawater desalination project is so far the largest scale exported EPC project. As LT-MED technology is first time ever converged with hot water flashing technology to produce distillate, the cost is greatly reduced by using low quality hot water as heat resource for distilling in this project. Leading seawater desalination technology keeps Shanghai electric expanding the market share and serves better.

## 全球首例 THE WORLD FIRST

工业余热利用MED装置  
MED Equipment with industrial waste heat utilization



吨水成本  
Total Cost of each  
cubic distilled water

下降 DROP

50%

与国外同类水平相比  
Compared with foreign similar level

**MED PROJECT**  
 热法项目

 国内化工行业规模最大热法海水淡化项目  
 LARGEST CAPACITY OF THERMAL SEAWATER DESALINATION PROJECT  
 IN CHINESE PETROCHEMICAL INDUSTRY

**ZHEJIANG ZHOUSHAN PETROCHEMICAL PHASE I,II 305000 TONS/D MED PROJECT**
**浙江舟山·浙石化一期、二期  
305000吨/天海淡EPC项目**

业主(Owner):

 浙江石油化工有限公司  
 Zhejiang petrochemical Co.,Ltd

容量(Capacity):

 105000 m<sup>3</sup>/d+ 200000 m<sup>3</sup>/d

技术方法(Technical Method):

MED-TVC、F-MED

所在地(Project Location):

浙江舟山 Zhoushan, Zhejiang Province

完成时间(Completion Time):

2022年

项目性能参数表 PROJECT PERFORMANCE PARAMETER TABLE

项目 Item	单位 Unit	技术数据 Technical Data
装置容量 Installed Capacity	m <sup>3</sup> /d	15000 / 25000
装置数量 Number of Devices	套 set	7 / 8
技术工艺 Technical Process	--	MED-TVC、F-MED
蒸发器效数 Evaporator Effect Number	--	7 / 12
造水比 GOR	kg/kg	10.5 / 14.7
产品水水质 Desalination Quality	mg/L	≤5
负荷调节范围 Load Regulation Range	%	50-100
年利用率 Annual Utilization Ratio	%	95
设计寿命 Design Life	年 year	30

浙石化4000万吨炼油化工一体化项目配套7×1.5万吨/日和8×2.5万吨/日低温多效蒸馏海水淡化EPC项目由上海电气工程承包，是国内化工行业最大规模且采用了热水闪蒸和蒸汽作为加热源的双工况海水淡化项目，在国内石化行业具有示范作用。海水淡化装置可以实现MED-TVC和F-MED两种模式的切换，满足不同工况的需求。

Zhejiang petrochemical 40 million tons of refining and chemical engineering integration project is assorted with 7×15000 tons/day and 8×25000 tons/day of low temperature multi-effect seawater desalination project, in which the engineering and procurement is contracted by Shanghai electric. As the model demonstration in Chinese petrochemical industry, the project not only contains the largest capacity of seawater desalination, but also can be supplied with hot water as the heating resource. The seawater desalination system is designed to meet the request of various operating condition by switching operating mode between MED-TVC and F-MED.

浙石化项目充分利用炼化工艺过程产生的热水余热资源，配套上海电气自主研发的热水闪蒸一体化专利设计技术，实现了能源的梯级利用。该项目成功实现全球领先的节能环保型国产化热法海水淡化新技术的工程应用示范，对于全面提升国产化热法海水淡化技术装备的国际竞争力具有里程碑的意义。

The project makes full use of the hot water waste heat generated in the refining process, and combined with the patent of hot water flash developed independently by Shanghai Electric, realizing the cascade utilization of energy. The project realizes the engineering application demonstration of the world's leading energy saving and environmental friendly domestic thermal desalination technology, which is a milestone to comprehensively enhance the international competitiveness of domestic thermal desalination technology and equipment.



# 反渗透脱盐技术

环保、低能耗、高经济效益的膜法脱盐技术

## REVERSE OSMOSIS

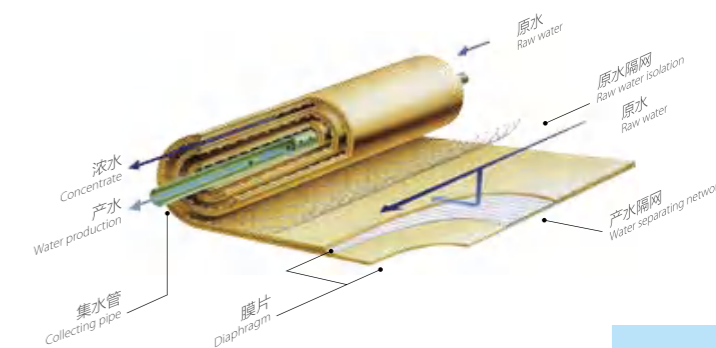
ENVIRONMENTAL PROTECTION, LOW ENERGY CONSUMPTION, HIGH ECONOMIC EFFICIENCY OF MEMBRANE DESALINATION TECHNOLOGY

反渗透海水淡化是利用选择性渗透膜从海水中分离出淡水，其具有投资小、能耗低、建设周期短和适用范围广等特点。反渗透海水淡化核心设备包括反渗透膜、高压泵和能量回收装置等。

上海电气经过持续研发和工程经验积累，在系统设计、设备集成、安装调试和运行维护等方面处于国内领先水平，目前已具备万吨级单膜堆系统设计、工程配套和工程总承包能力。公司能够为市政、电力、化工和钢铁等领域客户提供完整的个性化系统解决方案。

Reverse osmosis technology separates water from seawater by using permeable membrane; it has many advantages, including less investment, low energy consumption, short construction period and extensive application etc. The key RO equipments consist of membrane, high pressure pump and energy recovery device etc.

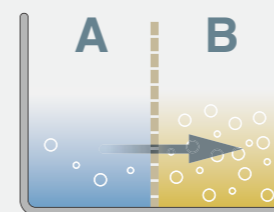
Through continuous research and the accumulation of engineering experience, SEC has a leading level in system design, equipment integration, installation and commissioning, maintenance, and now has a capability to provide engineering service about the single SWRO stack with permeate capacity of 10,000 t/d. We can provide a complete personalized system solution for customers in municipal, electric power, chemical industry, iron and steel and other fields.



### 技术原理图

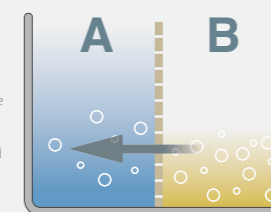
#### TECHNICAL FLOW CHART

##### 渗透 Osmosis



在外界压差小于渗透压时，淡水侧 A 水分子会自发透过 RO 膜，移动到盐水侧 B。  
When the external pressure is less than the osmotic pressure, Freshwater side A water molecules spontaneously through the RO film, moved to the brine side B.

##### 反渗透 Reverse Osmosis



当给予盐水侧 B 大于渗透压的外界压力时，盐水中的水分子则会移动到淡水侧 A。  
When given saline side B is greater than the osmotic pressure, External pressure, water molecules in brine will move to the water side of A.



## 反渗透工程业绩 RO PROJECT REFERENCES

序号 NO.	国家/地区 Country/Region	行业 Industry	项目名称 Project Name	产水量 Capacity	投运时 间(year) Commission Time
1	中国河北 HeBei, China	钢铁 Steel	河北丰南·丰越能源 HeBei Fengnan.Fengyue Energy	75000m <sup>3</sup> /d	2019
2	中国广东 GuangDong, China	电力 Electric Power	广东惠来电厂 GuangDong Huilai Power Plant	11880m <sup>3</sup> /d	2011
3	印尼公主港 Palabuhanratu, Indonesia	电力 Electric Power	印尼公主港电厂 Palabuhanratu Power Plant	7680m <sup>3</sup> /d	2012
4	越南永新 Vinh Tan, Vietnam	电力 Electric Power	越南永新电厂二期 Vinh Tan Power Plant Phase II	9600m <sup>3</sup> /d	2014
5	伊拉克华事德 Wsait, Iraq	电力 Electric Power	伊拉克华事德电厂二期 Iraq Wsait Plant Phase II	4800m <sup>3</sup> /d	2014
6	菲律宾康赛普森 Conception, Philippines	电力 Electric Power	菲律宾康赛普森电厂一期 PCPC Power Plant Phase I	2640m <sup>3</sup> /d	2016
7	中国广东 GuangDong, China	电力 Electric Power	广东华厦西电二期 GuangDong YangXi Power Plant Phase II	4128m <sup>3</sup> /d	2018
8	马来西亚巴林基安 Bahrainkian, Malaysia	电力 Electric Power	马来西亚巴林基安燃煤电厂 Bahrainkian Coal-fired Power Plant	3300m <sup>3</sup> /d	2018
9	巴拿马科隆 Colon, Panama	电力 Electric Power	巴拿马科隆燃气电站 Panama Gas Turbine Power Plant	3618m <sup>3</sup> /d	2020
10	中国浙江 ZheJiang, China	石化 Petrochemical	浙江石化海水淡化项目一期增补 Zhejiang Petrochemical RO Phase I Expansion (EP)	1500m <sup>3</sup> /d	2020
11	巴基斯坦塔尔 Thar, Pakistan	电力 Electric Power	巴基斯坦塔尔电厂 Pakistan Thar Power Plant RO Project	6240m <sup>3</sup> /d	2021
12	迪拜 Dubai	电力 Electric Power	迪拜光热和光伏太阳能电站除盐水 700MW CSP and 250MW PV Hybrid Project RO System,	9600m <sup>3</sup> /d	2021
13	伊拉克米桑 Maysan, Iraq	电力 Electric Power	伊拉克米桑800MW 燃气联合循环电站锅炉补水 raq Maysan GTCC Power Plant (800MW) Boiler Make-up Water RO Project	3168m <sup>3</sup> /d	2021
14	塞尔维亚 Serbia	电力 Electric Power	塞尔维亚潘切沃燃气联合循环电站锅炉补水项目 Pancevo GTCC Power Plant RO Project (EP),	8640m <sup>3</sup> /d	2021
15	中国广东 GuangDong, China	电力 Electric Power	汕特燃机天然气热冷联产项目锅炉补水 Shante CCHP Boiler Make-up Water Project	15552m <sup>3</sup> /d	2022
16	中国江苏 Jiangsu, China	石化 Petrochemical	江苏苏尔邦二期丙烷产业链项目水处理站 Jiangsu Sierbang Propane Project Phase II Water Treatment Station	45000m <sup>3</sup> /d	2022
17	中国河北 HeBei, China	市政 Municipal	唐山海港经济开发区海水淡化工程 Tangshan Haigang Economic Development Zone Seawater Desalination Project	100000m <sup>3</sup> /d	2023/2025
18	中国烟台 Yantai, China	石化 Petrochemical	山东裕龙石化膜法海水淡化项目 Shandong Yulong Petrochemical RO Project (EPC)	80000m <sup>3</sup> /d	2024
19	中国广东 GuangDong, China	电力 Electric Power	广东粤惠来电厂海水淡化及锅炉补水项目 Guangdong Yuedian Huilai Power Plant Seawater Desalination and Boiler Makeup Water Project	13464m <sup>3</sup> /d	Est.2025



## 特有的 5 大技术优点

降低能源消耗，提升产水水质，  
提高社会效益

### FIVE OWN UNIQUE TECHNICAL ADVANTAGES

REDUCE ENERGY CONSUMPTION, INCREASE THE QUALITY OF PRODUCT WATER,  
IMPROVE SOCIAL BENEFIT

1 多种预处理工艺组合，  
针对各种源水水质，  
保障反渗透系统运行稳定

A combination of various pretreatment process, Ensure the stability of the RO system for all kinds of raw water.

2 专业的计算软件，  
完整模拟反渗透运行周期

Related software application to completely simulate RO operation cycle.

3 合理配置系统，优化设备结构，  
满足各种运行工况需求

Rational configuring system, optimization of equipment structure, meet the requirements of various operating conditions.

4 根据现场条件灵活布置，  
优化管道布局，高效利用空间，  
节约土建成本

Flexible layout according to the site condition, optimize the piping layout, make the most use of the space, save the cost of civil works.

5 系统自动化率高，  
降低人力成本和故障风险

Efficient automation control system, reduce manpower costs and risk of failure.

RO PROJECT  
膜法项目



## TANGSHAN HAIGANG ECONOMIC DEVELOPMENT ZONE 100000 TONS/D BOO SEAWATER DESALINATION PROJECT

### 唐山海港经济开发区 100000吨/天BOO海水淡化工程

唐山申港海水淡化有限公司成立于2020年10月，为唐山海港城市发展公司和上海电站辅机厂有限公司的合资企业，是从事海水淡化服务的专业公司，旨在解决唐山海港经济开发区内用水短缺问题，提升区内水资源综合利用能力。公司的宗旨是为开发区及区内企业提供“可靠稳定、绿色节能、环保高效”的水资源利用解决方案。

Tangshan Shengang Seawater Desalination Co., Ltd., established in October 2020, is a joint venture between Tangshan Seaport City Development Co., Ltd. and Shanghai Power Station Auxiliary Equipment Plant Co., Ltd. It is a professional company engaged in seawater desalination system, aiming at solving the water shortage problem and improving comprehensive utilization of water resources of Tangshan Haigang Economic Development Zone. The purpose of the company is to provide "reliable and stable, green and energy saving, environmental friendly and efficient" water resources utilization solutions for the development zone and its enterprises.



大型卧式砂滤  
Large horizontal  
sand filter

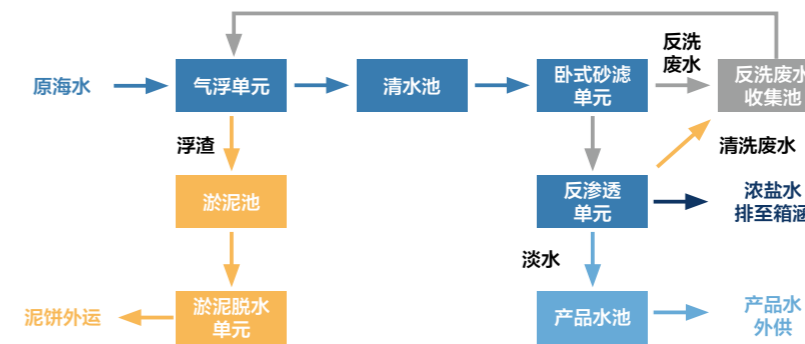
反渗透膜堆  
RO Device



国内单机最大反渗透海淡项目  
THE LARGEST PER-UNIT INSTALLED CAPACITY DOMESTICALLY  
CONSTRUCTED RO DESALINATION PROJECT

海水淡化主要采用如下工艺流程，核心装置包括气浮、卧式砂滤、反渗透装置等。

Seawater desalination mainly adopts the following process flow, and the core devices include air flotation, horizontal sand filtration, reverse osmosis device, etc.



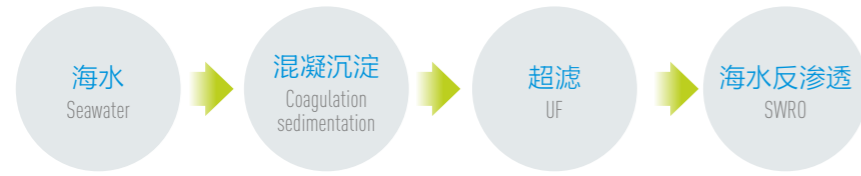
预处理采用气浮及砂滤工艺。溶气气浮利用微小气泡加速上浮分离，提高分离效果的同时降低药耗。澄清出水浊度低于5NTU。采用大型卧式砂滤系统对澄清后的海水进行深层介质过滤，去除剩余的悬浮颗粒。介质过滤操作简单，经济性高。经介质过滤处理后，出水浊度低于1NTU，SDI15值低于5，满足反渗透进水要求。

Air floatation and sand filtration techniques are used for pretreatment. Dissolved air floatation uses tiny bubbles to accelerate the separation, improve the separation effect and reduce the drug consumption. The turbidity of clarified effluent is less than 5NTU. Large scale horizontal sand filtration system is used to filter the clarified seawater in deep media to remove the remaining suspended particles. The operation of medium filtration is simple and the economy is high. After medium filtration, the effluent turbidity is less than 1 NTU, and the SDI15 value is less than 5, which meets the requirements of reverse osmosis.

过滤器出水直接进入海水淡化反渗透系统以脱除大多数溶解性固体。反渗透系统总脱盐率大于99%，产水电导率低于500 μS/cm。单套反渗透膜组淡水产量达25000m<sup>3</sup>/d，为国内最大。

The effluent from the filter directly enters the desalination reverse osmosis system to remove most of the dissolved solids. The total desalination rate of RO system is more than 99%, and the conductivity of produced water is less than 500 μS/cm. The fresh water output of single set of reverse osmosis membrane is 25000 m<sup>3</sup>/d, which is the largest in China.

工艺流程 TECHNOLOGICAL PROCESS



RO PROJECT  
膜法项目



## VINH TAN POWER PLANT 9600 TONS/D RO PROJECT 越南永新9600吨/天膜法海淡项目

永新二期海淡工程不仅为电厂提供了所需的工业用水，还为后续锅炉补水系统提供了高质量的进水；海水反渗透产水相较传统预处理后的地表水，能够优化后续系统的运行条件，延长设备的使用寿命，且不受旱季河水干涸问题的困扰。

The phase II project of seawater desalination in Yongxin not only supplies the necessary industrial water for the power plant, but also delivers the high quality water for the subsequent boiler make up water system; compared with the pretreated surface water by traditional technology, the fresh water extracted from seawater by reverse osmosis technology can optimize the operating conditions in the followed system, which can extend the service lifetime of the equipment. And it will be untroubled when the river is dried up during dry season.

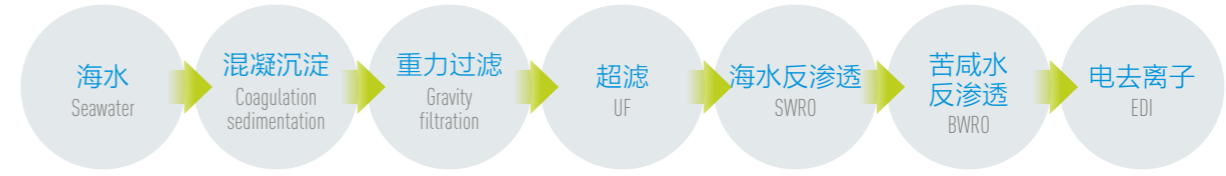
BWRO产水量 SWRO CAPACITY

9600m<sup>3</sup>/d

配套发电机组2 × 622MW  
Auxiliary generator set 2 \* 622MW



工艺流程 TECHNOLOGICAL PROCESS



RO PROJECT  
膜法项目



## PHILIPPINE PCPC POWER PLANT 2640 TONS/D RO PROJECT 菲律宾PCPC 2640吨/天膜法海淡项目

PCPC项目包含完整的工艺流程，多重预处理工艺组合能够应对复杂恶劣的水质条件，为后续反渗透系统提供良好的运行环境；

采用运行更为稳定、产水水质更好的EDI代替传统的离子交换工艺，为电厂提供高质量的工业水和锅炉补水，对于电厂稳定运行具有重大意义。

PCPC project contains the complete technological process, and the multiple pretreatment combined process is able to deal with complex water quality conditions, and can provide an excellent operating condition for the subsequent reverse osmosis system; in addition, PCPC project uses EDI (electrodeionization) that has the advantages of better stable operation and higher product water quality instead of traditional ion exchange technique, with the purpose of providing the quality industrial water and boiler make up water, making a great significance for stable operation of power plant.

BWRO产水量 SWRO CAPACITY

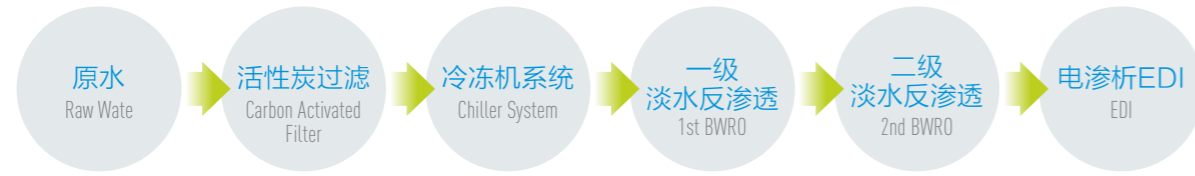
2640m<sup>3</sup>/d

配套发电机组2 × 135MW  
Auxiliary generator set 2 \* 135MW





工艺流程 TECHNOLOGICAL PROCESS



RO PROJECT  
膜法项目



### DUBAI MAKTOUM SOLAR PARK SOLAR THERMAL PHASE IV PLANT DEMINERALIZED WATER PROJECT

— THE LARGEST CSP&PV HYBRID PLANT AUXILIARY PROJECT

## 迪拜马克图姆光热园区四期 9600吨/天除盐水项目

— 全球最大光伏光热混合电站配套项目

迪拜光热除盐水系统满足了电厂机组工业、消防、生活水等用水需要；

设置冷冻机换热系统，在夏季原水温度高于35℃的情况下，仍能保证了反渗透进水温度的稳定。

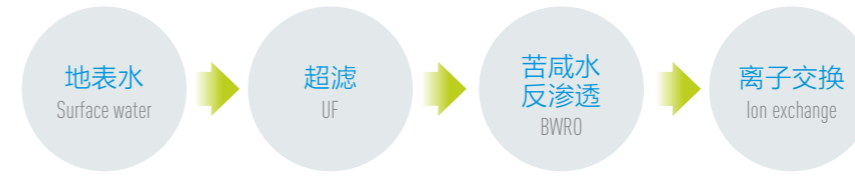
The product water meets all kinds water needs of the power plant including industrial, fire-fighting, domestic water, etc.  
The chiller system is designed to ensure the stability of the RO feed water temperature even when the raw water temperature is higher than 35 C in the summer condition.

一级BWRO产水量 SWRO CAPACITY

9600t/d

配套复合发电机组700MW光热+250 MW光伏  
Auxiliary 700MW CSP & 250MW PV Hybrid Project

工艺流程 TECHNOLOGICAL PROCESS



RO PROJECT  
膜法项目



### GUANGDONG YANGXI POWER PLANT 4128 TONS/D DEMINERALIZATION PROJECT

## 广东阳西电厂4128吨/天锅炉 补给水项目

为电厂提供工业用水及锅炉补给水，稳定性要求高；

配套超超临界发电机组，产水水质要求高；

In order to provide industrial water and boiler make up water for power plant, the system require a high stability; and the project equips with ultra-supercritical unit, so the quality requirements of product water of project is higher.

BWRO产水量 SWRO CAPACITY

4128m<sup>3</sup>/d

配套发电机组2 × 1240MW  
Auxiliary generator set 2 \* 1240MW



# 热膜耦合海水淡化技术

集成热法和膜法技术优势的创新型海水淡化技术

## THERMAL & MEMBRANE HYBRID SEAWATER DESALINATION TECHNOLOGY

INNOVATIVE SEAWATER DESALINATION TECHNOLOGY THAT INTEGRATES THE ADVANTAGES OF THERMAL AND MEMBRANE PROCESS

上海电气水务公司通过热法和膜法海淡工艺有机融合和系统流程优化成功开发了新型余热利用热膜耦合海水淡化技术。耦合新工艺可实现系统热量、海水和产水等能介的工艺创新组合和高效梯利用，大大降低项目整体的平布占地、项目投资和制水成本，形成高效、经济、低碳、环保的海水淡化工程应用技术创新解决方案。目前上海电气水务成功打造了河北丰南钢铁、山东裕龙石化等大型热膜耦合海水淡化工程应用示范，经济效益和社会效益显著。

Shanghai Electric Water Engineering Company has successfully developed a new type of thermal and membrane hybrid seawater desalination technical solution with waste heat utilization through combining and optimizing thermal and membrane processes. The new hybrid process has achieved innovative combination and efficient utilization of system heat, seawater, and product water. It can greatly reduce the plant layout, project investment and operational cost. So the new F-MED-RO hybrid process is an efficient, economical, low-carbon, and environmentally friendly innovative technical seawater desalination solution. At present, Shanghai Electric has successfully built large-scale hybrid seawater desalination demonstration projects and, such as Hebei Fengnan Steel project and Shandong Yulong Petrochemical project. These have achieved significant economic and social benefits.

### 三大热膜耦合方式：

#### THREE THERMAL AND MEMBRANE HYBRID SYSTEMS:

##### 热量利用耦合：

热法排放热量用于预热膜法进料海水，保障冬季膜法进料最低海水温度要求，降低膜法全年制水电耗，提高运行稳定性。

Thermal Energy Hybrid System: The discharge thermal energy of F-MED system is used to preheat the membrane feed seawater that can guarantee the minimum feed seawater temperature of the membrane process in the winter condition. This will reduce the annual electricity consumption of the membrane process and improve system operational stability.

##### 海水利用耦合：

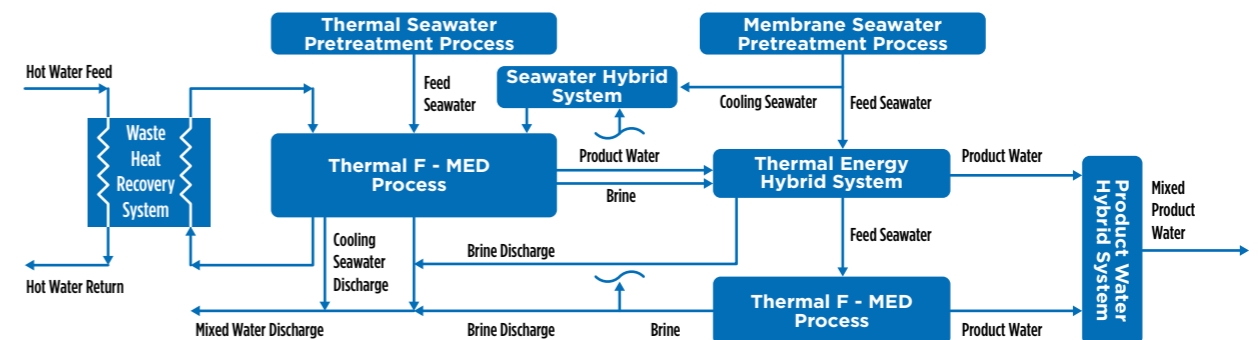
膜法浓盐水用于热法的冷却水，减少海水取排水量、海水预处理规模和占地，降低项目投资。

Seawater Hybrid System: the brine of membrane is used as cooling seawater of thermal process, reducing seawater intake capacity, seawater pretreatment scale and layout and project investment.

##### 产水调质耦合：

将热法产水与膜法产水按一定比例混合调质外供，减少产水配套后处理工艺段投资，提高全厂供水水质稳定性、供应能力和检修调度能力。

Product Water Hybrid System: The thermal and membrane product water is mixed together in a certain proportion according to the quality of requirements. This hybrid system not only reduce investment of product water post-treatment but also improve the stability of product water quality, capability of water supply and O&M.



RO-MED HYBRID PROJECT  
热膜耦合项目



第三代热膜耦合F-MED-RO技术  
THE THIRD GENERATION F-MED-RO HYBRID TECHNOLOGY

## SHANDONG YULONG PETROCHEMICAL 160000 TONS/D F-MED-RO HYBRID PROJECT (EPC)

# 山东裕龙石化160000吨/天 热膜耦合海淡项目

业主(Owner):

山东裕龙石化有限公司  
Shandong Yulong Petrochemical Co.Ltd

容量(Capacity):

160000m<sup>3</sup>/d

技术方法(Technical Method):

热膜耦合  
热法: F-MED-TVC  
膜法: 混凝沉淀—V型滤池—超滤—SWRO—  
BWRO+矿化

所在地(Project Location):

山东省烟台市Yantai Shandong Province

完成时间(Completion Time):

在建(预计2024年12月完工)  
Being under construction (Scheduled to be  
completed in December,2024)

膜法项目性能参数表 PROJECT PERFORMANCE PARAMETER TABLE

项目 Item	单位 Unit	技术数据 Technical Data
装置容量 Installed Capacity	m <sup>3</sup> /d	20000 (以SWRO产水计)
装置数量 Number of Devices	套 set	4
技术工艺 Technical Process	-	混凝沉淀—V型滤池—超滤— SWRO—BWRO+矿化
RO回收率 Recovery rate of RO	%	45% (SWRO) 85% (BWRO)
产品水水质 Product Water Quality	mg/L	≤12
吨水电耗 Tons of Water Consumption	kWh/m <sup>3</sup>	≤3.6 (以SWRO产水计)

裕龙岛炼化一体化项目(一期)海水淡化工程总产水规模为16万吨/天,包括海水预处理系统、8万吨/天膜法海水淡化系统和8万吨/天热法海水淡化系统。

The seawater desalination plant of Yulong Island Refining and Petrochemical Integration Project (Phase I) owns a total capacity of 160,000 tons/day, and it is composed of seawater pretreatment system, 80,000 tons/day membrane seawater desalination system and 80,000 tons/day thermal seawater desalination system.

膜法海水淡化系统采用V型滤池—超滤—两级反渗透工艺。超滤装置共14套,采用大框架对称布置以减少占地。当海水水温较低时超滤给水会通过热膜耦合换热器,与热法浓盐水换热升温,以达到进膜最佳温度,大大提升膜装置运行效率,降低制水电耗。海水反渗透装置共4套,部分产水进入淡水反渗透装置进一步脱盐后作为除盐水处理系统给水;部分产水进入矿化滤池矿化调质后作为全厂生产水。

The membrane seawater desalination system adopts V Filters-Ultrafiltration-Two-Pass Reverse Osmosis scheme. The ultrafiltration unit consists of 14 sets of devices, and each device is symmetrically arranged as a large rack to reduce floor space occupation. In the ultrafiltration process, when the seawater temperature is low, the ultrafiltration feed water will enter the heat exchangers and be heated by the concentrate from the thermal desalination system. Through this design, the feed water would reach the optimal temperature for the membrane system, which can greatly improve the operational efficiency of membrane devices and reduce the power consumption. The SWRO (Seawater Reverse Osmosis) unit consists of 4 sets of devices. A portion of SWRO product water is sent to the BWRO (Brackish Water Reverse Osmosis) devices for further desalination, and then the BWRO product water will be used as feed water for the demineralized water treatment system. The other part of the SWRO product water is delivered to the remineralization filters, and used as utility water for the entire plant after mineralizing.

RO-MED HYBRID PROJECT  
热膜耦合项目



热法海水淡化系统采用余热利用热水闪蒸-低温多效蒸馏工艺，按照热水和蒸汽双模式设计，可实现热水和蒸汽模式独立切换运行。炼化厂低温余热热水由东北角进入，经换热提供热量后返回。低压蒸汽由主管廊进入，作为备用热源，在投运初期无热水或检修期间热水停供时保证热法装置产水。热法物料水采用两倍浓缩以提高海水利用率，减少预处理规模。热法产水作为除盐系统给水由主管廊外供，浓盐水经热膜耦合换热器预热膜法进水后排至全厂排水总管。

The thermal seawater desalination system adopts waste heat utilization hot water flash – Low-temperature Multi-Effect Distillation (MED) scheme. The system is designed as the dual heat source mode of hot water and steam, which can realize the switching and operation of hot water and steam mode. The refinery's low-temperature water with waste heat enters the thermal desalination system from the northeast corner, and then returns to the refinery after providing heat. The low pressure steam delivered through the main pipe corridor is used as a back-up heat source to guarantee the water producing of the thermal desalination devices when there is no hot water at the operation beginning or when the hot water supply is stopped during maintenance. The thermal feed water is doubly concentrated to improve seawater utilization, thus reducing the pretreatment scale. The thermal desalination product water is delivered through the main pipe corridor to the demineralized water system as feed water. The concentrate is discharged to the drainage main pipe after preheating the membrane feed water through heat exchangers.



第三代热膜耦合F-MED-RO技术  
THE THIRD GENERATION F-MED-RO HYBRID TECHNOLOGY

热法项目性能参数表 PROJECT PERFORMANCE PARAMETER TABLE

项目 Item	单位 Unit	技术数据 Technical Data
装置容量 Installed Capacity	m <sup>3</sup> /d	20000
装置数量 Number of Devices	套 set	4
技术工艺 Technical Process	--	F-MED-TVC
蒸发器效数 Evaporator Effect Number	--	10
产品水水质 Desalination Quality	mg/L	≤5
负荷调节范围 Load Regulation Range	%	50-100
年利用率 Annual Utilization Ratio	%	95
设计寿命 Design Life	年 year	30

裕龙海水淡化项目采用创新性热水闪蒸+热膜耦合工艺，实现低温余热梯级利用，显著提高系统整体运行效率，极大降低制水成本。高品质产水一方面保障裕龙炼化全厂生产用水需求，同时也大大减少对周边地表水及地下水开采，有效节约了淡水资源，实现“让水于民”，充分践行绿色低碳发展理念，实现了良好的经济效益和社会效益。

The Yulong seawater desalination project has adopted innovative hot water flash and RO-MED hybrid scheme to realize the multistage utilization of low temperature waste heat, which has significantly improved the overall operation efficiency of the system and reduced the costs of the desalination plant. The production of the high-quality water guarantees the water demand for the entire plant, and also significantly reduces the exploitation of surrounding surface water and groundwater, thus effectively saving the fresh water resources. The project has fully reflected the idea of "Let water serve the people", implemented the concept of green and low-carbon development, and realized good economic and social benefits.

RO-MED HYBRID PROJECT  
热膜耦合项目



## HEBEI FENGNAN FENGYUE ENERGY 75000TONS/D RO COUPLED WITH 25000 TONS/D MED DESALINATION PROJECT UNDER EPC MODE

# 河北丰南·丰越能源75000吨/天RO & 25000吨/天MED海淡EPC项目

业主(Owner):

河北丰越能源科技有限公司  
Hebei Fengyue Energy & Technology Co. Ltd

容量(Capacity):

75000 m<sup>3</sup>/h

技术方法(Technical Method):

混凝沉淀-重力滤池-超滤-两级反渗透

所在地(Project Location):

河北省唐山市 Tangshan, Hebei Province

完成时间(Completion Time):

2019年

项目性能参数表 PROJECT PERFORMANCE PARAMETER TABLE

项目 Item	单位 Unit	技术数据 Technical Data
装置容量 Installed Capacity	m <sup>3</sup> /d	12500
装置数量 Number of Devices	套 set	6
技术工艺 Technical Process	-	混凝沉淀-重力滤池-超滤-两级反渗透 Clarifier- GSF-UF-SWRO-BWRO
RO回收率 Recovery rate of RO	%	45%(SWRO) 85%(BWRO)



国内首个热膜耦合海水淡化EPC项目  
THE FIRST DOMESTIC HYBRID SEAWATER DESALINATION EPC PROJECT



该项目为国内钢铁行业规模最大热膜耦合EPC项目，充分贯彻落实“余热利用、降低成本、安全可靠”的设计原则，为钢厂提供了稳定可靠、成本低廉的淡水供应，系统运行高效、布置紧凑，其投资和运维成本均处于业内领先水平。

The project applies the largest RO-MED hybrid system under EPC mode in domestic iron and steel industry, fully implementing the "waste heat utilization, cost reduction, safety and reliability" design principles. Reliable and cost effective fresh water is provided for the steel plant. The efficient and compact system design allows a leading CAPEX & OPEX.

上海电气充分发挥低温多效技术优势和高效热水闪蒸专利设计技术，从钢厂的高炉冲渣废热中提取出热水作为热源。这种低温多效和余热利用相结合的全新设计技术在经济性和可靠性指标达到国际先进水平。

Shanghai Electric makes full use of the MED technical advantages and high efficient hot water flashing patented design technique. The waste heat of the blast furnace slag water is recovered, exerting the hot water flash technical advantages at a maximum degree and reaching an international advanced level in the indexes of economic and reliability.

业主(Owner):

河北丰越能源科技有限公司  
Hebei Fengyue Energy & Technology Co. Ltd

容量(Capacity):

25000 m<sup>3</sup>/h

技术方法(Technical Method):

F-MED

所在地(Project Location):

河北省唐山市 Tangshan, Hebei Province

完成时间(Completion Time):

2019年

项目性能参数表 PROJECT PERFORMANCE PARAMETER TABLE

项目 Item	单位 Unit	技术数据 Technical Data
装置容量 Installed Capacity	m <sup>3</sup> /d	12500
装置数量 Number of Devices	套 set	2
技术工艺 Technical Process	--	F-MED
蒸发器效数 Evaporator Effect Number	--	6
造水比 GOR	kg/kg	10
产品水水质 Desalination Quality	mg/L	≤ 5
负荷调节范围 Load Regulation Range	%	50~110
年利用率 Annual Utilization Ratio	%	95
设计寿命 Design Life	年 year	30



上海电气水务致力于为国内外客户提供工艺集成创新、环境友好、成本优势领先的废水整体解决方案。上海电气开发出基于预处理、浓缩减量和末端固化的业内领先的创新型废水零排放工艺路线，并具备提供从专业技术方案咨询，工程方案设计，设备成套供应和工程总承包的能力。

SEWE is committed to offering customers integrated solutions in wastewater with process integrative innovation, environmental friendly and cost advantage. Shanghai Electric has developed a leading innovative wastewater ZLD technical route based on pretreatment, concentration reduction and end-solidification. SEWE provides across the entire chain from professional proposal consultation, engineering design, equipment supply and EPC.

## 废水处理核心技术

### THE KEY TECHNOLOGY IN WASTEWATER TREATMENT

# 废水处理技术

工艺集成创新、环境友好、成本优势领先的整体解决方案

## WASTEWATER TREATMENT TECHNOLOGY

WASTEWATER INTEGRATED SOLUTIONS WITH PROCESS INTEGRATIVE INNOVATION  
ENVIRONMENTAL FRIENDLY AND COST ADVANTAGE

- |  |  |   |
|--|--|---|
| <p>1 高效预处理技术<br/>Efficient Pretreatment Technology</p> | <p>2 深度氧化处理技术<br/>Advanced Oxidation Technology</p>                              | <p>3 反渗透浓缩技术<br/>RO Concentration Technology</p>          |
| <p>4 蒸发浓缩技术<br/>Thermal Concentration Technology</p>   | <p>5 载气萃取浓缩技术<br/>High-concentration Carrier Gas Extraction (CGE) Technology</p> | <p>6 分盐结晶处理技术<br/>Salt and Crystallization Technology</p> |

## 高效预处理技术 EFFICIENT PRETREATMENT TECHNOLOGY

通过技术改进,将各类高效反应、分级过滤、精准加药技术应用用于高盐水软化、除硅处理中,极大的提高预处理效率、降低药剂成本、减少设备占地面积、降低设备维护成本。

Through technical improvement, various high-efficiency reaction, grading filtration and precision dosing technology are applied to high salt water softening and silicon removal treatment, which greatly improves pretreatment efficiency, reduces cost and equipment footprint.

## 深度氧化处理技术 ADVANCED OXIDATION TECHNOLOGY

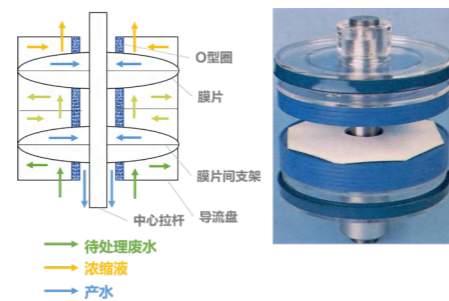
将臭氧催化氧化、电催化氧化等深度氧化技术与杂盐分盐过程充分结合,有效提高分盐效率,极大地降低分盐成本,提高副产盐的回收率。

The deep oxidation technology is fully combined with the salt separation process, which effectively improves the salt separation efficiency and greatly reduces the salt separation cost.

## 反渗透浓缩技术 RO CONCENTRATION TECHNOLOGY

反渗透浓缩技术是利用反渗透膜将废水浓缩减量,实现纯水回收和浓盐水减量,具有投资低、占地面积小、仅依靠电力驱动等特点。上海电气依托于海水淡化处理中的膜法工程经验,已成功开发出高回收率反渗透浓缩技术,可应用于各类废水的深度脱盐处理,降低整个零排放系统的投资及运行成本。

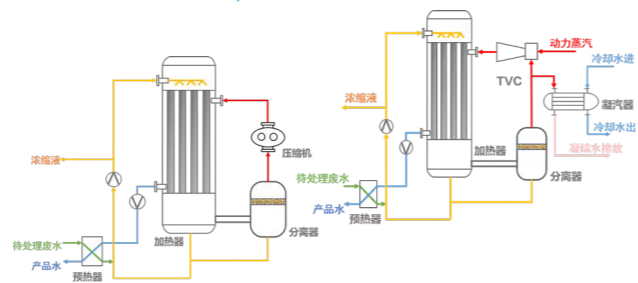
Based on the experience of membrane engineering in seawater desalination treatment, SEW has successfully developed a high-recovery reverse osmosis concentration technology, which can be applied to deep desalination treatment, reducing the investment and operating costs of the entire zero-emission system.



## 蒸发浓缩技术 THERMAL CONCENTRATION TECHNOLOGY

蒸发浓缩技术是利用热能将部分淡水从废水中分离出来,实现废水的浓缩减量,根据废水水质和热源条件的不同,常用的技术类型包括多效蒸发(MED)、机械压缩(MVC)和热压缩(TVC)。上海电气通过在热法领域不断的探索和创新,将海水淡化工艺中的各类热法技术延伸应用于废水处理,可对厂区各类余热进行深入挖掘,为客户提供低能耗的余热利用系统解决方案。

According to different wastewater quality and heat source conditions, common thermal concentration technologies include MED, MVC and TVC. SEW extends these technologies in the wastewater desalination process, which can make the most of waste heat in the plant and provide customers with waste heat utilization system.



## 分盐结晶处理技术 SALT AND CRYSTALLIZATION TECHNOLOGY

结晶处理是将废水进一步浓缩,直到将废水中淡水和结晶盐类彻底分离,最终实现废水的零排放。上海电气拥有纳滤分盐、冷冻结晶分盐技术,可提高杂盐副产收率,实现杂盐资源化。同时还拥有采用烟气余热蒸发结晶技术,可充分利用烟气余热,极大降低结晶单元的投资和运行成本。上海电气根据项目设计条件为客户提供个性化、低成本的结晶方案。

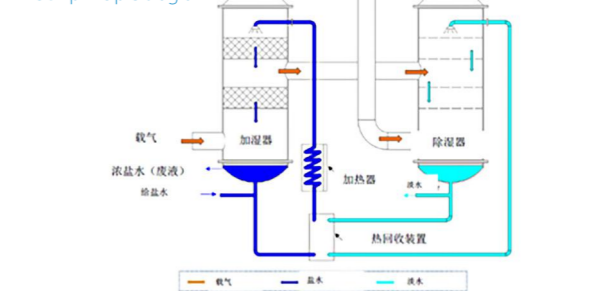
SEW has the technology of nanofiltration and freezing crystallization, which can improve the yield of by-products and realize the resource utilization of carnallite. At the same time, we also adopt flue gas crystallization technology, which can make full use of waste heat in flue gas, greatly reducing the investment and operating cost.

## 载气萃取浓缩技术 HIGH-CONCENTRATION CARRIER GAS EXTRACTION (CGE) TECHNOLOGY

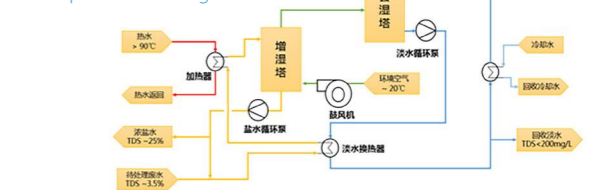
载气萃取(CG E)是一种通过空气的增湿去湿过程实现废水浓缩减量的创新水处理技术,其具有预处理要求低、运行温度低、防腐防垢性能优良、废水浓缩倍数高、传热传质效率高、运维工作简单等技术特点,特别适合于高含盐废水的浓缩减量。CGE技术对热源要求极低,可使用厂区内的各类废蒸汽、热水、烟气余热等,大幅降低运行成本,目前已成功在国内外电厂脱硫废水、页岩气开采废水等领域废水零排放工程中商业化应用。

CGE is an innovative water treatment technology and the characteristics lies in low pretreatment requirements, excellent anti-corrosion and anti-scaling performance, and high concentration of TDS in brine. CGE has extremely low requirements on heat sources, and can use various types of waste steam, hot water, and flue gas in the plant to greatly reduce operating costs.

CGE基本工作原理图  
CGE principle diagram



CGE工艺流程图  
CGE process flow diagram



技术路线 TECHNICAL ROUTE



TYPICAL ENGINEERING PROJECT 典型的工程案例



## CEMENT CIRCULATING COOLING WASTEWATER ZLD PROJECT 水泥行业循环冷却排污水零排放

水泥厂余热发电循环水运行过程中，由于水质严重超标，造成凝汽器结垢严重，同时环保要求零排放处理，上海电气采用包含预处理、浓缩减量和蒸发结晶在内的完整零排放技术工艺流程，成功实现循环冷却排污水的零排放。本项目由上海电气负责项目工程设计和设备成套供货，在国内水泥行业具有示范意义。

SEWE adopts complete zero emission technology including pretreatment, concentration reduction and evaporation crystallization. The process has successfully achieved zero discharge of circulating cooling sewage. The project is designed and the equipment is supplied by Shanghai Electric, and has fundamental significance in the domestic cement industry.

项目技术参数 PROJECT TECHNICAL PARAMETERS

水质特点(Wastewater Quality Characteristics) :
悬浮物含量、含盐量和COD含量较高 The circulating sewage has high suspended solids, salt and organic matter.
完成时间(Completion Time):
预计2019年 Est.2019
产水用途(Water purpose):
回用至循环冷却水补充水 Reused to supplement cooling water

技术优势 TECHNICAL ADVANTAGES

高回收率 High recovery rate	膜系统总回收率高达98%，尽量减小进入蒸发结晶的废液量。 The total recovery rate of the membrane system is up to 98%.
特殊的流程设计 Special process design	化学软化放在一段浓缩之后，减小软化沉淀设备规模，降低反渗透和蒸发结晶系统结垢污堵风险。 Concentration is followed by Chemical softening, which can reduce the scale of softening and sedimentation equipment.
零排放与原循环水系统配合 Combine the ZLD system with the original circulating water system	混合部分原水进入循环水系统，降低反渗透产水的“腐蚀性”。 Mix part of the raw water into the circulating water system and reduce the corrosiveness of RO permeate.

技术路线 TECHNICAL ROUTE



TYPICAL ENGINEERING PROJECT 典型的工程案例



## ZLD PROJECT IN MINE INDUSTRY 煤矿采出水零排放项目

根据国家和地方相关生态环保政策要求，必需实现矿井水零排。该项目采用膜法和热法相结合的零排放处理方案，为应对项目所在地冬季水温较低，特殊设计余热回收系统，减少热耗，降低运行成本。该项目系统配置简单，自动化程度高，整个系统投资和运行成本优势显著。

According to the requirement of national and local environmental protection policies, mine waste water should achieve ZLD. The project adopts a zero-emission treatment scheme combining membrane method and thermal method. The special design (waste heat recovery system) reduces heat consumption and operating costs. The system configuration is simple, the degree of automation is high, and the overall investment and operating cost advantages are significant.

项目技术参数 PROJECT TECHNICAL PARAMETERS

水质特点(Wastewater Quality Characteristics) :
盐度较高，需脱盐处理；硬度较高，考虑到对脱盐单元的影响，需去除部分硬度。 The water has high salinity and hardness.
产水用途(Water purpose):
部分作为全厂自用水，其余作为煤化工工业园补充用水 Supplementary water

技术优势 TECHNICAL ADVANTAGES

工艺路线简单 Simple technical route	系统配置简单，减小运维工作量； Simple system configuration, less operation and maintenance
系统可靠性高 High system reliability	高盐废水工段，操作自动化程度高，平时维护简单方便，可以保证98%以上的运行时间。 High degree of operation automation, simple and convenient maintenance, more than 98% of running time guaranteed.
回收余热，降低蒸汽消耗 Recover waste heat and reduce steam consumption	采用零排放系统内的余热来预热进入反渗透的废水，可降低蒸汽耗量，降低运行成本。 Use waste heat from a ZLD system to preheat the wastewater, reducing steam consumption and operating costs.
选用合适的软化药剂，降低药剂消耗，减小污泥量 Select appropriate softening agent to reduce the consumption of chemicals and the sludge volume	



技术方法 TECHNICAL ROUTE



INDUSTRY WATER  
工业废水



## ZLD PROJECT IN IRON AND STEEL INDUSTRY 钢铁行业废水零排放项目

钢厂现有废水直接排海造成了恶劣的社会影响，要求实现零排放。项目为提高副产盐类的资源化利用，上海电气针对其水质制定了分盐的零排放技术工艺流程，产出的淡水作为生产用水，纳滤浓水送往焦化厂消纳，在实现零排放的同时产出氯化钠工业盐。

In order to improve the resource utilization of by-product salt, SEW has formulated a zero-discharge technology process to produce fresh water and industrial salt.

项目技术参数 PROJECT TECHNICAL PARAMETERS

水质特点(Wastewater Quality Characteristics) :

待处理废水来自中央水厂反渗透浓水，含盐量高，钙硬度高，有机物含量高。  
The water has high salt content, high calcium hardness and high organic content.

产水用途(Water purpose):

生产补水  
Reused to make up water

技术优势 TECHNICAL ADVANTAGES

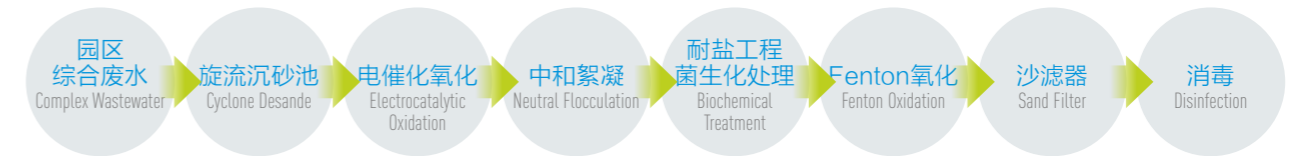
应用分盐技术  
Salt separation technology

采用纳滤分盐技术，副产出结晶氯化钠工业盐。  
Using NF and salt separation technology to produce NaCl as by-product.

优化流程设计  
Special process design

将软化和混凝沉淀组合，优化预处理单元，减小后续离子交换的规模  
Combining softening and coagulation precipitation which can save the installation of pretreatment .

技术路线 TECHNICAL ROUTE



INDUSTRY WATER  
工业废水



## COMPREHENSIVE INDUSTRIAL WASTEWATER TREATMENT PROJECT 综合工业废水治理项目

工业园区废水处理厂收集处理园区企业排放废水，园区内企业主要包括农药制药厂、冶金、电子及农产品加工等，采用电催化氧化→高效工程菌生化的技术路线。可快速降解废水中污染物同时保持系统的稳定运行。

Chemical Industrial complex Wastewater Treatment Plant collects and treats the wastewater form various industrial plants mainly include pesticide plants, metallurgy, electronics and agricultural plants, using electrocatalytic oxidation engineering bacteria as main technology route. It can quickly degrade pollutants in wastewater and keep the system operating stably.

项目技术参数 PROJECT TECHNICAL PARAMETERS

水质特点(Wastewater Quality Characteristics) :

水质波动范围较大，含盐量高，毒性大，可生化性低。  
The wastewater has large fluctuation range, high salt content, high toxicity and low biodegradability.

产水用途(Water purpose):

达标排放（《城镇污水处理厂污染物排放标准》（GB18918-2002）一级A标准）。  
Meet standard and discharge, GB18918-2002.

技术优势 TECHNICAL ADVANTAGES

可靠性高  
High reliability

系统充分降解水中难降解有机物，保证出水水质稳定  
The system can degrades organics in water efficiently and ensure the effluent quality

运行成本低 LOW OPERATING COST

7.22

综合运行成本在7.22元/吨（含污泥干化费用）  
The composite operating cost is 7.22 CNY / ton (including sludge dewatering costs)



## WHOLE SOLUTION PLAN

### 整体解决方案

根据用户实际项目设计条件，通过合理技术工艺选择、优化工艺系统和设备方案设计，最终为用户提供技术先进、系统可靠和经济节能的整体解决方案。整合资源，简化客户流程，提高效率，带来更好的客户满意度，进一步加强与客户间的信任，建立了一种区隔性的竞争优势。

According to customer's actual project design conditions, we can provide the advanced ,reliable and economical total solution, through the reasonable technology process selection, optimization of process systems and equipment design. Integrate resources, simplify processes, improve efficiency, bring better satisfaction, further strengthen mutual trust and cooperation.

为您所想，解您所忧  
为您“量身定做”个性化解决方案

THINK FOR YOU, SOLVE YOUR WORRIES  
YOU "TAILOR-MADE" CUSTOMIZED SOLUTIONS

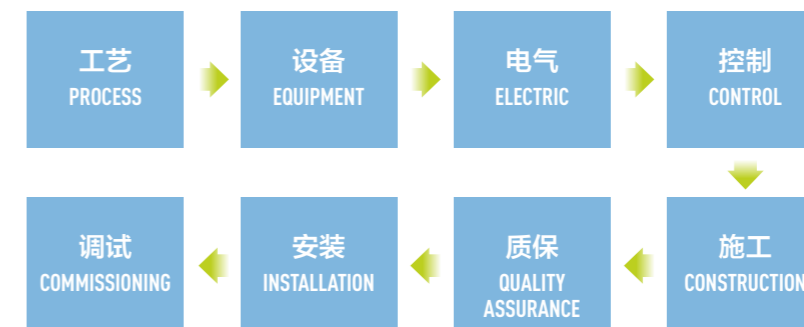


## 完整的工程设计体系

### COMPLETE ENGINEERING DESIGN SYSTEM

企业拥有众多高素质设计及项目管理人员，专业涵盖工艺、设备、电气控制、安装、调试、质量保证及现场施工等。

We own a range of excellent designers and project managers, specializing in process, equipment, electric control, commissioning, installation, Quality Assurance and construction.



## 雄厚的技术研发实力

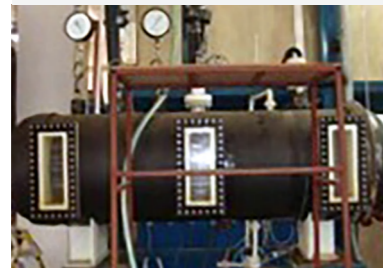
### STRONG TECHNICAL R&D CAPABILITY

上海电气电站水务工程公司踏实进行海水淡化及废水处理技术储备和自主研发，已攻克多项海水淡化及废水处理领域的核心技术瓶颈，形成了一批具有自主知识产权的科研成果。目前公司开发21个专业计算软件、建立9个数据库、搭建15个实验平台、获得授权专利33项、制定13项企业标准，研发成果处于国内领先水平。

Shanghai electric has been engaged in the development and application of seawater desalination technology, expanding water-electricity cogeneration mode. Within the past ten years, Shanghai Electric has had a step by step technical accumulation and independent R&D, with a breakthrough in several core seawater desalination technology, and got a series of independent intellectual property rights. Successfully developed 21 professional computing software, established 9 databases, built 15 experimental platforms, and applied for 33 patents, issued 13 enterprise standard.

#### 横管降膜蒸发器机理研究实验平台

Research & experiment platform for mechanism of horizontal tube falling film evaporation



#### 卧式热水闪蒸模拟体实验平台

Research & experiment platform for horizontal hot water flash simulator



具有强大的技术研发队伍，拥有研究生以上学历的员工比例为45%

With a strong technical R & D team, with a graduate degree or above, the proportion of employees is 45%



获得国家科技部“十二五”科技支撑重点项目——大型低温多效海水淡化系统集成技术与工程示范

Access to the national Ministry of science and technology "12th Five-Year" key projects of science and technology support - large-scale low temperature multi effect desalination system integration technology and engineering demonstration



牵头成立国内首个热法海水淡化产业创新战略联盟

Led the establishment of the first domestic hot water desalination industry innovation strategic alliance

## 工业余热利用F-MED中试平台

### F-MED PILOT PLATFORM ON INDUSTRIAL WASTE HEAT UTILIZATION



研究利用化工、钢铁等行业丰富的低品位热水余热资源，实现余热回收利用制取淡水，极大的降低了热法海水淡化的制水成本

MAKE FULLY USE OF THE LOW GRADE HOT WATER WASTE HEAT RESOURCES IN CHEMICAL AND STEEL INDUSTRIES, AND OBTAIN FRESH WATER UTILIZING WASTE HEAT RECOVERY, WHICH HAS GREATLY REDUCED THE MED WATER PRODUCTION COST.

#### 膜法海淡试验平台

REVERSE OSMOSIS SEAWATER DESALINATION PILOT PLATFORM



#### 废水蒸发结晶中试平台

EVAPORATIVE CRYSTALLIZATION PILOT PLATFORM ON INDUSTRIAL WASTE WATER



## 卓越的项目管理团队 及高效执行

### EXCELLENT PROJECT MANAGEMENT TEAM AND EFFICIENT EXECUTION

上海电气电站水务工程公司具有丰富的项目管理经验和众多成功业绩，其中大型EPC项目业绩共有四个，分别是宝钢湛江5万吨热法项目，丰南钢铁10万吨热膜耦合项目，秦皇岛6000吨方形热法项目以及浙江石化一期10.5万吨热法项目。在十多年的实践中，我们培养起一支专业高效的项目经理、现场经理、QC经理和调试经理管理团队，总结了一套行之有效的项目管理体系，确保项目高效执行。

SEWE has a wealth of project management experience and numerous great references, including four large project under EPC mode, such as 50000 tons of Baogang Zhanjiang Steel MED project, 100000 tons of Fengnan RO coupling with MED project, 6000 tons of Qinhuangdao square MED project and 105000 tons of Zhejiang petrochemical Phase MED project. In the past more than ten years of practice, we have trained a professional and efficient management team of project manager, site manager, QC manager and commissioning manager, and summarized a set of effective project management system to ensure the efficient implementation of the project.

我公司执行的EPC项目从任务目标及时间段进行分解，可以分为四个阶段：  
The EPC project execution can be divided into four stages:



每个阶段的各个部门均有详细的计划（设计计划、项目计划、采购计划、质量计划等等），并采用周报和月报相结合的模式予以追踪考核，确保计划的实施和纠偏。

Each department at each stage has a detailed plan (design plan, project plan, procurement plan, quality plan, etc.), which will be tracked and evaluated by weekly and monthly reports to ensure the implementation and correction.

公司承接EPC项目后，组建专门的项目经理部，配齐资源和人员组织项目实施，按合同、协议要求保质保量完成。

A project management department is set up after undertaking an EPC project. All resources and personnel are allocated to organize the project implementation to complete the project with quality and quantity guaranteed according to the contract and agreement.

聚焦客户需求，提供优质服务，持续创造价值  
FOCUSING ON CLIENT REQUIREMENT,  
PROVIDING QUALIFIED SERVICE, CREATING  
VALUE CONSISTENTLY

## 完备的质量管理体系 及经验丰富的监造队伍

### COMPLETE QUALITY MANAGEMENT SYSTEM AND EXPERIENCED SUPERVISION TEAM

为了保证项目有序、高效、高质按期完成，上海电气电站水务工程公司对于每一个项目都制定完整的项目质量保证大纲（PQAP），质量大纲覆盖整个设计、采购、分包商管理、制造、装配、包装、储运、安装和调试阶段。特别是对每个分包部件都单独制定技术采购规范（TPS）和配套的产品质量控制计划（QCP）。公司对海淡主设备的制造和安装焊接质量尤为关注，所有焊接操作人员要通过上海电气焊工考试中心的培训、考试和评定后才能上岗操作。

公司所有的分包商均严格通过技术、制造、人员设备和质保能力进行评审，每半年都要进行供方能力评价，在诸多项目的执行中去芜存菁，形成了一支基本稳定的供应商队伍。

公司拥有一支经验丰富的监造队伍，监造工程师拥有PT、UT、MT和RT等证书，部分人员拥有国际知名监理公司工作经历。所有的主设备采用监造工程师驻厂监造的模式全程监控，并每周出具监造周报，在配套件验收上，监造工程师采用巡检制，基本覆盖出厂验收环节，出具成品验收报告，确保产品质量。

In order to ensure the completion of the project on schedule orderly, efficiently with high-quality, SEWE has developed a complete project quality assurance program (PQAP) for each project, covering the whole design, procurement, subcontractor management, manufacturing, assembly, package & storage, installation and commissioning stages. In particular, technical purchase specifications (TPS) and quality control plans (QCP) are developed for each subcontracted component. The company pays special attention to the welding quality of the manufacturing and installation of MED main equipment. All welding operators can work only after passing the training, examination and evaluation of Shanghai electric welder examination center.

All company's subcontractors are strictly reviewed on the technical, manufacturing, personnel and equipment and quality assurance capability aspects. Subcontractors are optimized by capability evaluation every half a year, forming a basically stable supplier team.

SEWE has an experienced supervision team, supervision engineers have PT, UT, MT and RT certificates, some of whom have international famous supervision company work experience. All the main equipment shall be monitored by the supervision engineer stationed on site to supervise the whole process, and submit supervision report weekly. The inspection system is adopted in the acceptance of accessories, basically covering the factory acceptance.

# 强大的制造建设能力

## STRONG MANUFACTURE AND BUILD CAPABILITY

“国际一流，五十年不落后”的上海电气临港重型装备制造基地，为大型海水淡化设备的制造和运输创造了条件。奠定在大规模现代装备制造领域的国内外引领地位，支撑上海电气装备制造业的可持续发展。

Shanghai Electric LinGang Heavy Equipment Manufacturing Base, world leading with 50 years no backward, has created conditions for the manufacture and transportation of large-scale desalination equipment. Established a leading position in the field of large-scale modern equipment manufacturing, and support the sustainable development of Shanghai Electric manufacturing industry.



临港重型制造总装车间面积达34992平方米,具备320吨的起重能力,拥有1000吨泊位的自备码头和铁路专用线。

The LinGang Heavy Equipment Manufacturing assembly workshop covers an area of 34992 square meters, has 320 tons of lifting capability, and has 1000 tons of berths、 self-contained wharf and special railway lines.



临港重型制造总装车间具有先进的配套设备,具备百万级核电站凝汽器等大型热交换器和日产2.5万吨级以上的大型海水淡化蒸发器的组装能力。

Lingang heavy workshop owns advanced equipment. Assembly capacity of large scale heat exchangers and other large seawater desalination plants with a capacity of 25 thousand tons and more than one million nuclear power station condenser, etc.

**1400t** 重型厂房起吊能力/码头最大起吊能力  
Heavy lifting capacity building / pier maximum lifting capacity

## 世界一流的钻孔中心

### WORLD CLASS DRILLING CENTER



我们拥有 **34992m<sup>2</sup>** 临港重型制造总装车间